COUNTY OF SAN LUIS OBISPO

THE LAND USE AND CIRCULATION ELEMENTS
OF THE SAN LUIS OBISPO COUNTY GENERAL PLAN

ENERGY ELEMENT

ADOPTED BY
THE SAN LUIS OBISPO COUNTY BOARD OF SUPERVISORS
APRIL 25, 1995 - RESOLUTION 95-168

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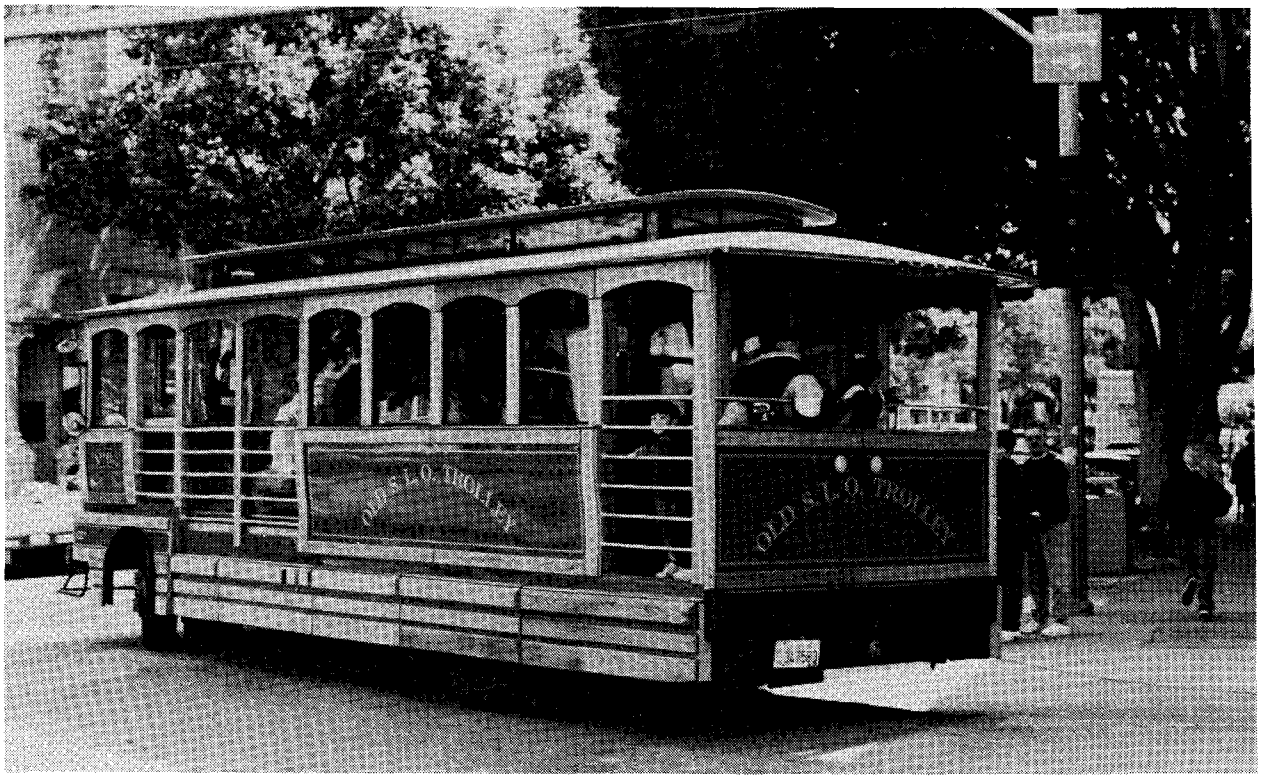
Report Funding

This document was prepared as a result of work sponsored by the California Energy Commission (CEC) through a Siting and Permit Assistance grant program. The State Legislature established the California Energy Commission in 1974 as the state's principal energy planning and policy making organization in order to address the energy challenges facing the state. The policies formulated by the CEC are intended to provide a reliable and affordable energy supply. The policies must also be consistent with protecting the state's environment and its public health, safety, and general welfare.

CHAPTER 1: INTRODUCTION



The production, transportation, and use of energy by our society raises important public policy issues involving the activities of both government and the private sector. Energy issues affect commerce, the provision of public services, land use planning and development, transportation, as well as most other aspects of daily life.

Using energy more wisely (energy conservation and efficiency) will save residents and businesses money and will lead to a better environment. Changes in land use patterns, transportation systems, building designs, agricultural practices, and recycling efforts can all lead to greater energy efficiency and conservation. Even changes in how electricity is produced can lead to greater energy efficiency. For example, a cogeneration facility can increase efficiency by using left over heat from an industrial process to make electricity. Conversely, a cogeneration facility could first generate power and then use the waste heat for a commercial process. The energy required to generate both the electricity and the useful heat in the cogeneration facility can be significantly less than the energy require to generate the electricity and useful heat in separate processes.

The county has abundant resources (in the form of sunlight and biomass) that can be used to generate electrical energy for local use. However, the county lacks the facilities to take advantage of such resources. In particular, a solar energy conversion facility in the Carrizo

Plains could minimize the county's reliance on imported electricity. A decreased reliance on imported energy resources would have positive impacts on the county. For example, the money that results from the production and distribution of energy will remain in the county and strengthen the local economy. The local economy would also benefit from the monies used to build and operate the facility. However, the environmental and social impacts of any power plant and electrical transmission line facilities must be carefully evaluated prior to approval of such facilities.

There are several oil and gas fields in San Luis Obispo County. There is also an extensive network of pipes, pump stations, storage tanks, and marine terminals to transport the oil resources. The maintenance and operation of such facilities continues to be an important issue in the county.

Purpose and Benefits of the Energy Element

The purpose of the Energy Element is to 1) increase energy efficiency in the county, 2) provide policy guidance regarding the implications of energy use, 3) document the county's energy resources, 4) determine land use and environmental criteria for evaluating future energy projects, and 5) provide alternatives which encourage exceeding the state's energy regulations for new construction.

The benefits of having an Energy Element generally come in two categories: economic and environmental. Economic advantages include:

- The Energy Element encourages development patterns that concentrate development in a central area and provide a mix of services and jobs near housing. Because jobs and/or services are closer, this will result in fewer or shorter automobile trips and less money spent on automobile fuel and maintenance.

- Energy efficiency and conservation measures can reduce residential utility bills which increases the household disposable income and purchasing power. Likewise, such measures can reduce operating costs for businesses, which will result in lower overhead expenses and increased profits. When disposable income and business profits increase, the local economy is stronger because more dollars are generally spent in the community and re-circulate to local businesses and residents. Energy efficiency and conservation measures can reduce the need to build large scale power plants. Such facilities are expensive and may cause utility rate increases.

- The Energy Element encourages the development of local renewable resources, such as the solar potential in the Carrizo Plains. Such development could create local jobs and provides local sources of electricity. Also, the Energy Element encourages the development of smaller power producing facilities that meet local needs.

Development of energy resources often raises environmental concerns related to air and water quality, resource use, and hazardous waste disposal. The environmental benefits of such actions include:

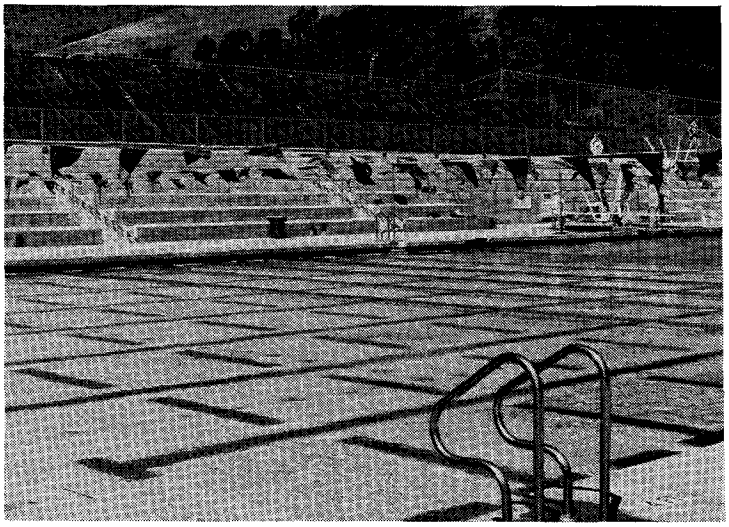
- Residents who live in compact communities tend to drive less (or at least drive shorter distances) because services are closer. Likewise, it is easier to establish convenient bus service in compact communities. Both these actions will lead to less traffic and enhanced air quality.

- Energy efficiency and conservation measures encourage residents and businesses to use less natural gas and electricity. Most power plants in California rely on natural gas or oil as fuel. With decreased electricity use, air quality will improve because less fossil fuels are burned. The need to build large power plants can be deferred or avoided, thereby avoiding environmental impacts associated with those plants.

- Using renewable fuel resources, such as hydroelectric, solar, and cogeneration, will decrease fossil fuel consumption or improve energy efficiency.

- Land use strategies that encourage compact communities in existing urban areas also act to preserve open space and agricultural land.

Methodology



This project was completed in cooperation with the Energy Element Technical Advisory Committee. The Energy Element was developed through a series of working papers. The first paper reviewed the county's environmental setting and documented the resources and constraints pertaining to local energy development. The second product, the Fossil Fuels Issues Working Paper, dealt with onshore oil and gas extraction, refining, and transmission. The Electricity Issues Working Paper dealt primarily with the existing conversion facilities in the county (namely the Diablo Canyon and Morro Bay power plants) and the potential development of any future fossil fuel conversion facilities. The fourth report (Renewable Resources Issues Working Paper) focused on conversion facilities that rely on renewable resources, such as solar, hydroelectric, wind, biomass, and geothermal technologies. This document also discussed cogeneration issues. The final interim product was the Conservation and Efficiency Issues Working Paper. This provided policies on how the

county could minimize energy consumption through land use planning, transportation systems, efficient building design, agriculture, energy education, and recycling and reuse.

After the working papers were completed, the advisory committee further refined the policies, programs, and guidelines. Meanwhile, work began on the environmental impact report (EIR) and the information in the working papers was summarized to provide a concise, manageable document. The result is the Energy Element and Program Level EIR.

It is anticipated that the element will need periodic updating as new information becomes available. This could result from technological improvements in any number of systems: lighting, photovoltaics, wind generation, transportation methods, fuel cells, or hydrogen fuels.

Components of the Element

Chapter 2 describes current energy use in San Luis Obispo County and the associated costs. This information provides an energy baseline—a snapshot in time of the county's energy budget. The chapter covers imported energy resources, local resources, and energy use by each sector of the economy: transportation, residential, commercial, agriculture, public facilities and institutions, and industry.

Chapter 3 identifies methods and opportunities for county residents and businesses to use energy more wisely through conservation and efficiency programs. Such programs include compact land use patterns; less reliance on cars and more on walking, biking, and riding the bus; more energy efficient homes and buildings; energy efficient county facilities; energy saving opportunities in agricultural practices; and recycling and reuse programs.

Chapter 4 covers electricity production and transmission. The chapter discusses both renewable resources, such as solar and biomass, and non-renewable resources, such as gas and nuclear fuel. Cogeneration, distributed facilities, and transmission lines are also reviewed.

Chapter 5 focuses on fossil fuel production. This includes pumps, wells, refineries, pipelines, and marine terminals.

Chapter 6 is the combined bibliography of all the documents used to prepare the working papers noted above.

Definition of Goals, Policies, Guidelines, and Programs

The policies and guidelines in this document are intended to serve as an educational resource for projects that require only ministerial approval. For discretionary projects, projects that need a public hearing, the element provides guidance and a range of alternatives for achieving the stated goals. The goals, policies, guidelines, and programs contained in the Energy Element provide

the foundation for reviewing energy related projects for consistency with the general plan. They also provide guidance for incorporating energy conservation and efficiency measures into other development projects. The following definitions identify the differences between a goal, policy, guideline, and program:

Goal

Goals are a general expression of community values, an ideal future result, or condition, related to public health, safety, or general welfare. Goals provide the vision statement of **what** is desired in the future.

Policy

Policies are more specific than goals. Policies are statements that guide decision making. Policies are based on the information gathered and analyzed during the process of developing the element.

Guideline

Guidelines provide direction on **how** to implement the goals and policies contained in the general plan. While guidelines may provide specific direction for addressing a particular issue, alternative approaches that achieve the same result may also be used.

Program

Programs are actions that may be initiated by the county or other public agencies to achieve specific community objectives. Because programs are recommended actions rather than mandatory requirements, county implementation should be based on consideration of community needs, support for the program, its related cost, and available funding.

Relationship to Other General Plan Elements

Government Code Section 65300 et seq. require the county to have a general plan that consists of seven mandatory elements. In addition to the required elements, the plan may include other optional elements, such as energy, which relate to the physical development of the county. Upon adoption, an optional element becomes an integral part of the general plan, with the same force and effect as the mandatory elements.

The general plan is required by law to be an internally consistent statement of community policy. Each element of the general plan must be integrated and consistent with all other elements. This element is related to many of the other elements of the county general plan: Land Use and Circulation, Agriculture and Open Space, Conservation, Recreation and Offshore Energy. The Local Coastal Plan policies portion of the Land Use Element also has policies relating to energy and industrial development.

User's Guide for the Energy Element

The following table should be used to identify project specific policies and guidelines.

Project	Goals/Policies	Guidelines	Chapter
New Developments, New Construction, New Subdivisions	Goal I Policies 1-6	1.1 - 1.2	3
	Goal II Policies 7, 8, 10	none	3
	Goal IV Policies 18, 19, 20	18.1, 18.2, 19.1	3
Electricity Generation and Transmission	Goal IX Policies 28-36	29.1-29.14	4
Renewable Energy Projects: Solar, Biomass, Wind, Hydro, Geothermal	Goal X Policies 37-43	29.1-29.14 39.1-39.4 40.1-40.10 42.1-42.7	4
Nuclear waste disposal	Goal XI Policy 44	none	4
Cogeneration	Goal XII Policies 45-48	46.1-46.6 29.1-29.14	4
Transmission Lines	Goal XIV Policies 49-51	51.1-51.32	4
Oil and Gas Facilities Facility Siting, Refineries, Pipelines, Marine Terminals, Storage Facilities	Goal XV Policies 52-65	53.1, 54.1-2 55.1-55.4 58.1-58.8 60.1, 64.1-2	5
The user should also consult the appropriate sections of the Local Coastal Plan, Land Use Ordinance, and other elements of the General Plan. These sections will provide specific information about the county's project review process and other standards that may apply.			

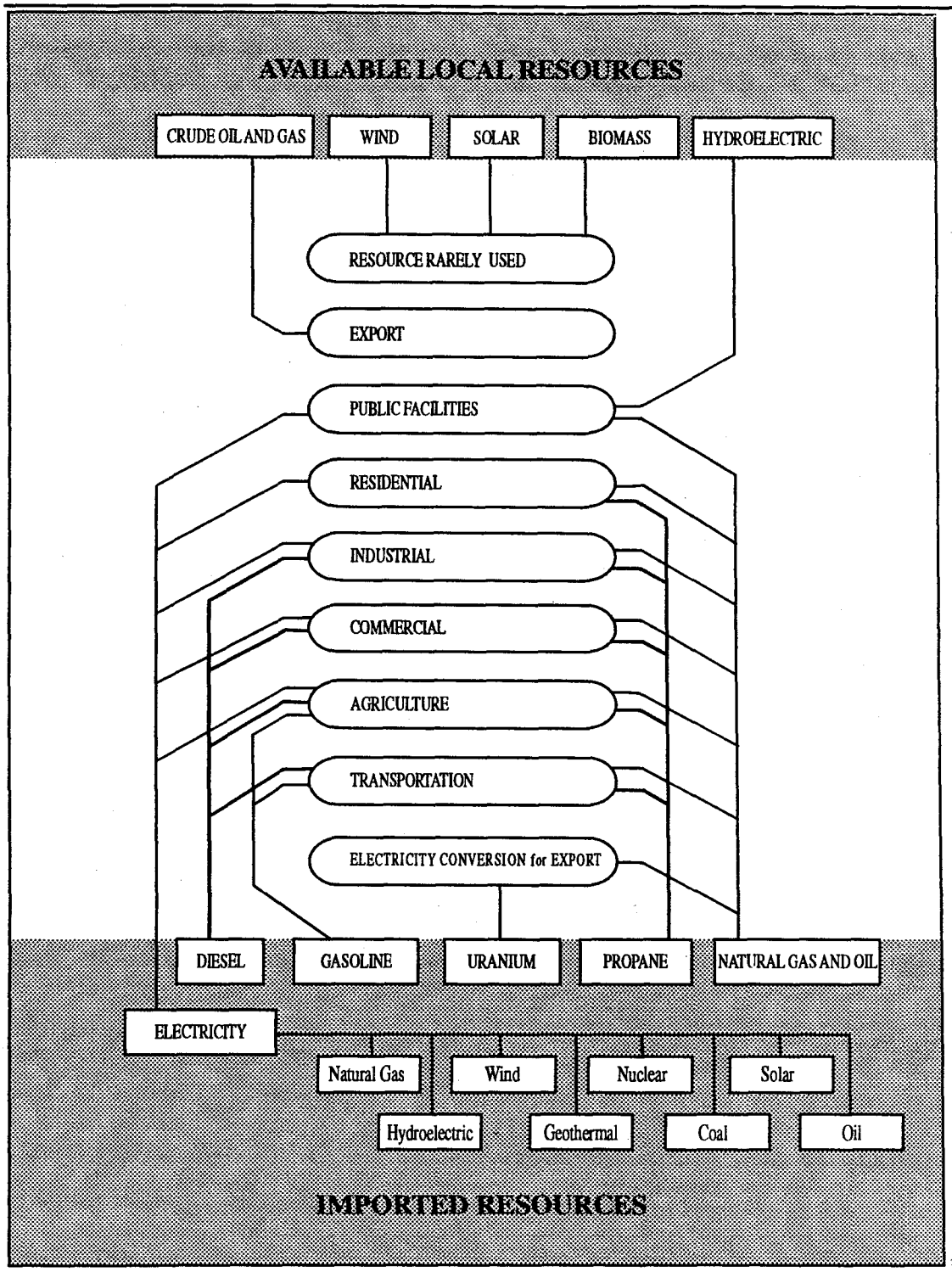
CHAPTER 2: ENERGY PROFILE

This chapter describes current energy use in San Luis Obispo County and the associated costs. This information provides an energy baseline—a snapshot in time of the county's energy budget. The chapter covers imported energy resources, local resources, and energy use by each sector of the economy: transportation, residential, commercial, agriculture, public facilities and institutions, and industry.

Figure 2-1 summarizes the relationship between energy resources and energy use. Local resources are shown at the top of the diagram. These include: crude oil and gas; biomass fuels; wind, tidal, and solar energy; and hydroelectric potential. Crude oil and gas are exported out of the county for refining and distribution. Only a small portion of the wind, solar, and biomass potential in the county is currently used. Various municipalities have built hydroelectric facilities that make use of the limited resource available. The electricity generated at these facilities is generally used for other public facilities.

Because local public institutions, residences, industries, businesses, farms, and ranches are not equipped to make direct use of local energy resources, the county relies on imported resources. Imported resources include diesel, gasoline, propane, natural gas, and electricity. (Note that electricity is not a natural resource, but is converted from many other fuel sources. The electricity county residents and businesses receive is generated from natural gas, wind, nuclear,

Figure 2-1: Summary of Energy Imports, Local Resources, and End Use



Data: San Luis Obispo County.
Source: Crawford, Multari, & Starr, 1994

solar, hydroelectric, geothermal, coal, and oil resources.) Although electricity is a very useful form of energy, considerable amounts of energy are lost in the process of creating and transporting electricity.

Imported Resources

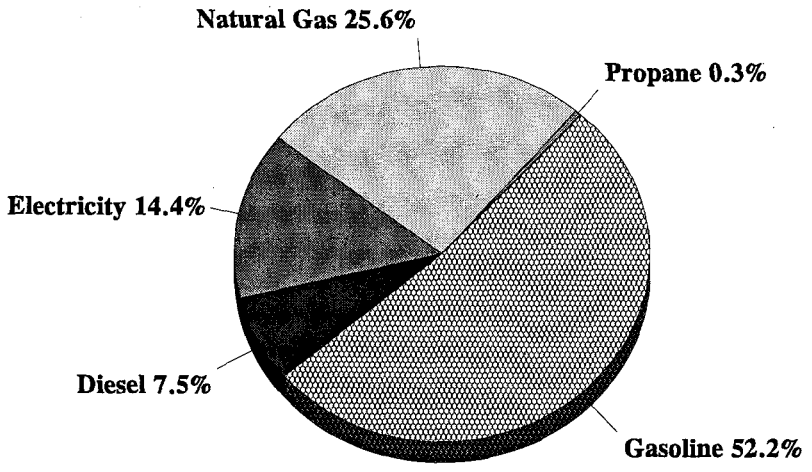
Energy resources are imported into the county primarily by the two major utilities that serve the county. Pacific Gas and Electric (PG&E) provides electricity and Southern California Gas Company provides natural gas. Propane is supplied by several private companies. Gasoline is imported via tankers and trucks. Uranium and natural gas are imported into the county for conversion to electricity which is then exported to the main California power grid in the San Joaquin Valley. San Luis Obispo County receives power from that grid. Although the county has less than 1 percent of the state's population we convert 10 percent to 15 percent of the electricity consumed in the state.

Imported Resources For Local Use

Figure 2-2 shows the amount of energy used by fuel type. A total of 26,000,000 MMBtu (million British thermal units) are imported for local use. Because a variety of fuels are used in the county (natural gas, electricity, propane, gasoline, diesel, wood burning stoves, etc), all comparisons are based on British thermal units (Btu).

Because the numbers are large, the standard measurement will be a million Btu (MMBtu). (Please refer to Appendix A for definitions of some basic energy terms.)

Figure 2-2: Local Energy Use by Fuel Type



Data: CEC, San Luis Obispo County, 1992.
Source: Crawford Multari & Starr, 1993.

Imported Resources For Conversion and Export

Two large power plants are located in the county. Morro Bay Power Plant (a fossil fuel facility) and Diablo Canyon Power Plant (a nuclear facility) convert imported fuel into thermal energy (heat) which is used to create steam, and finally electricity. Table 2-1 and Figure 2-3 compare the resources imported into the county for conversion at power plants and the electricity exported out of the county. More information is available in the *Environmental Setting Working Paper* on file with the Department of Planning and Building.

Table 2-1: Imported Energy Resources for Conversion by Power Plants
San Luis Obispo County 1992-Estimated

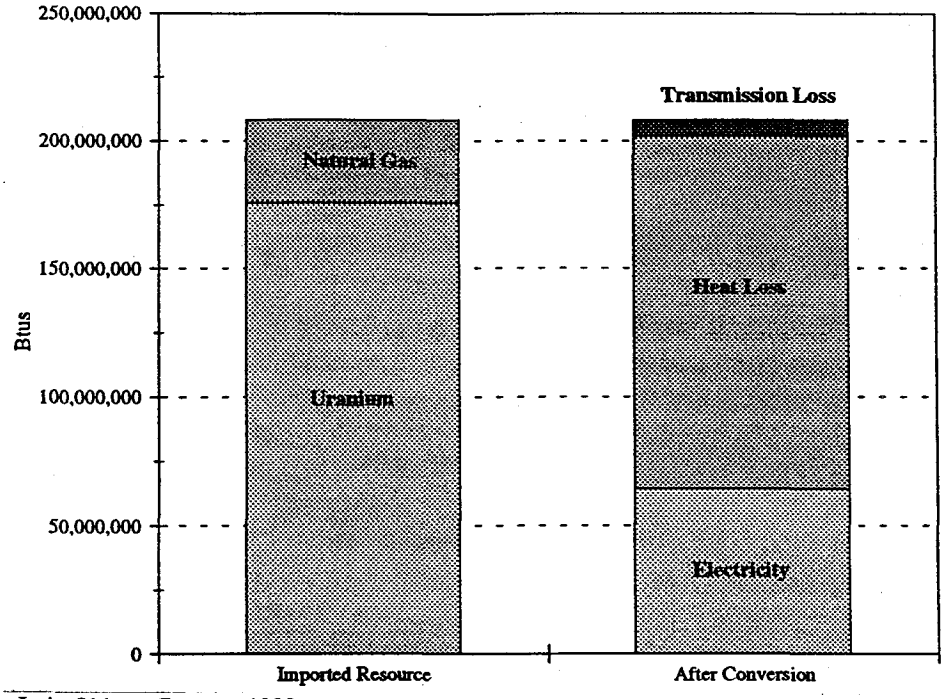
Fuel	Imported Resources (MMBtu)	Exported Electricity (MMBtu)
Uranium[1]	175,618,058	52,974,254
Natural Gas[2]	32,399,806	11,339,932
TOTAL	208,017,864	64,314,186

Notes: [1] Based on 2,262 MW capacity operating 87 percent of the time and a 30 percent conversion efficiency. Less the electricity used in production (10 percent). Does not include energy required to mine and process uranium.
[2] PG&E Morro Bay Power Plant operations. Does not include energy required to extract and process natural gas. Based on 35 percent efficiency.

An important consideration in energy production is that much of the energy resource is lost during conversion to electricity.[1] Most conversion procedures that rely on heating water to run steam turbines (including natural gas, nuclear, geothermal, coal, and oil) are only 30 to 35 percent efficient. If one considers the energy used for mining and extracting natural gas, coal, oil, and/or uranium, the efficiency rate drops even further. Over 208,000,000 MMBtu of energy were imported into San Luis Obispo County in 1992. In turn, the county generated 64,000,000 MMBtu of electricity for export out of the county.

[1] For an example of the energy lost in the conversion process, consider a pot of boiling water. To boil water, heat is applied to the pot which then transfers the heat to the water. During this process, energy (in the form of heat) is lost when the pot is being heated, in the steam that escapes while the water is boiling, and when the water is cooled.

Figure 2-3: Imported Resources to Produce Exported Electricity



Data: San Luis Obispo County, 1992.
Source: Crawford Multari & Starr, 1993.

State Resources

California is one of the largest users of energy in the nation. Nearly half of all energy consumed within the state is used to move people and goods. The state's residential and commercial sectors continue to rely on electricity and natural gas. Despite gains in diversifying the mix of energy resources used to generate electricity, over 90 percent of the total energy consumed by California still comes from fossil fuels.

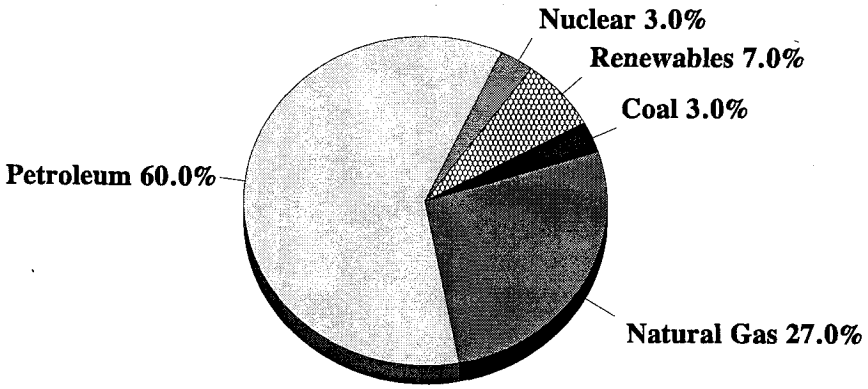
The two primary fuels used to power the state are petroleum and natural gas. Figure 2-4 illustrates California's energy resource mix for 1991. Almost 74 percent of the petroleum used in the state is consumed by the transportation sector. The following table shows California's energy mix:

Table 2-2: California Sources of Energy - 1992

Petroleum	Natural Gas	Electricity
47% California Production	16% California Production	65% California Generation
48% Alaska Imports	62% Other States	20% Southwest States
5% Foreign Imports	22% Canada	15% Pacific Northwest

Source: 1992-93 California Energy Plan, California Energy Commission

Figure 2-4: California's Energy Resources



Source: California Energy Commission

Local Resources

There are a number of energy resources that can be found or utilized within San Luis Obispo County, including natural gas, oil, wind, solar, biomass, and hydroelectric. In some cases (i.e., biomass and solar), the available resource is not presently used to its fullest potential. Some limitations include; the cost competitiveness of large scale systems, increased initial capital investment for buildings, and lack of economic incentives for developing a resource. Where the environmental consequences can be minimized, the use of local resources may offer the best alternatives to importing large amounts of energy from other areas of the state. Table 2-3 compares the available local energy resources to those actually used in the county.

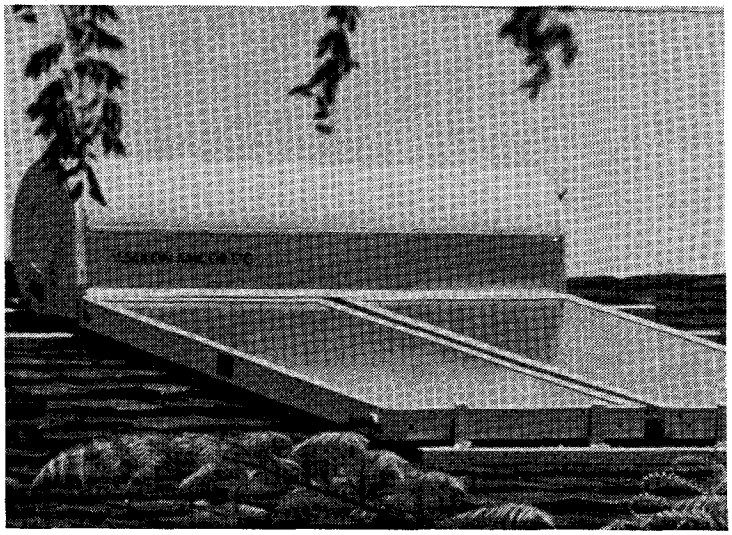
Table 2-3: Local Energy Resources
San Luis Obispo County 1992

Power/Fuel	Estimated Resource (MMBtu)	Resource Used (MMBtu)
Hydroelectric[1]	43,309	43,309
Biomass[2]	2,894,462	44,580
Solar[3]	54,555,600	55,459
Tidal	NA	NA
Wind	NA	NA
Crude Oil and Gas[4]	5,206,075	45,749
TOTAL	62,699,446	189,097

See notes on next page.

Notes: [1] Assumes that the existing electricity generation facilities make use of all the potential resource, not including the State Water project (see *Environmental Setting Report*).
[2] Biomass resource detailed in *Renewable Resources Issues Working Paper*. Use based on estimates of wood burning stoves in the county (Ewan, personal communications, and EIR).
[3] Solar potential based on 1,200 square feet of usable rooftop for every housing unit (90,200) in the county, plus a 20-acre facility in the Carrisa Plains, multiplied by .5 MMBtu per square foot radiation onto a horizontal surface. Use based on estimates of solar water heaters in the county (Ewan, personal communications).
[4] Based on resources extracted in 1991 (see *Fossil Fuels Issues Working Paper*).

Solar



The way in which solar energy can currently be harnessed include: making buildings more efficient at using the heating and lighting energy inherent in sunlight, installing roof mounted solar thermal systems that can be used for space or water heating, installing roof-mounted photovoltaic systems that can provide electricity for the building, or constructing large-scale facilities that create electricity for distribution to homes and businesses. The solar energy potential available in the county remains nearly unused. There are generally two ways in which the county could make better use of the available solar resource. The first is through construction of large-scale solar conversion facilities in the Carrizo Plains. The technology for these facilities is rapidly progressing, and it is likely that, with some local assistance and encouragement, a developer may undertake such a project in the next 10 to 15 years.

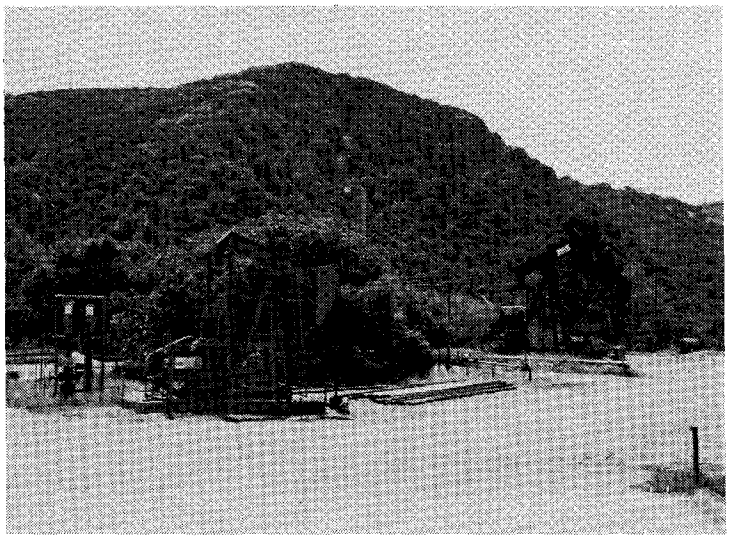
The county can also use the available solar resource through building design. Most of San Luis Obispo County has an ideal climate (relatively minor temperature fluctuations and many bright, sunny days) for solar heating and cooling of buildings. Methods for using solar energy resources in building design are described in Chapter 3.

Crude Oil and Gas

Once extracted, crude oil is refined and then distributed for use in automobiles, airplanes, industries, and power plants. Natural gas requires minimal refining prior to distribution to homes, businesses, and industries. More information about these resources is available in the *Fossil Fuels Working Paper* on file with the Department of Planning and Building or the state Division of Oil, Gas, and Geothermal Energy Resources office in Santa Maria.

Some of the crude oil produced in the county is partially refined at a facility at the Santa Maria Refinery (located on the Nipomo Mesa). The product is then shipped for further processing.

Crude oil is also transported out of the county via pipeline to other refineries. Natural gas produced in the county is extracted and used for processing crude oil at the Santa Maria Refinery or transported via pipeline with the crude oil products for later processing elsewhere. The county does not advocate additional refinery operations at this time. Oil and gas processing facilities generally create toxic pollutants and would increase the environmental risk to neighboring homes.



Hydroelectric

Energy can be captured from flowing water (hydroelectric energy) by using the water to turn a turbine. This is generally done in one of two ways: 1) placing large turbines at the outlet of a lake or reservoir or 2) placing smaller turbines in water-carrying pipes.

There is limited potential for hydroelectric energy from the county's lakes and reservoirs. The potential can best be captured by using small turbines in pipes that carry water to distribution facilities. One facility is planned in the county as part of the State Water Project. (It should be noted that the electricity produced as part of the state water project will not fully offset the amount needed to pump the water, resulting in a net energy loss.) There are, however relatively few additional locations with a consistent flow of water large enough to economically justify the turbine's installation cost. Also, the California drought cycle could often make such facilities inoperable for several years at a time. More information is available in the Renewables Working Paper on file with the Department of Planning and Building.

Biomass

Biomass refers to various organic waste products from agricultural and industrial processes, including recycled newspaper, wood pellets, tree trimmings, cow manure, crop residue, etc. Biomass can be burned to release heat energy (which in turn runs a turbine) or converted into natural gas. Biomass resources are detailed in Renewable Resources Issues Working Paper on file with the Department of Planning and Building. Wood consumption estimates are based on the approximate number of wood burning stoves operating in the county (Ewan, personal communications, and EIR).

San Luis Obispo County has a very large potential biomass resource in the form of livestock manure, waste paper, and crop residues. Currently, only a minor portion of this resource is

used, largely in residential fireplaces and wood stoves. There are no appropriate conversion facilities to make use of the greater resource available. Also, the cost of collection may be a potential impediment to development of this resource. With some local assistance and encouragement, a developer may be willing to undertake the project.

Wind

Power from wind has been used for centuries to pump water for crop irrigation, to propel sailing ships across the sea, and to run millstones to grind flour from grain (Fowler, 1984). In the case of wind turbines, the wind causes the blades to rotate, generating mechanical energy that is converted to electrical energy by a generator.

As designs and performance have improved, the cost of wind power has declined dramatically. The levelized cost of electricity generated by modern wind turbines is now estimated to be 6¢ to 9¢ per kilowatthour (kWh), down from over 25¢/kWh in 1981. One advantage of wind power is that operations and maintenance costs can be quite low. Operating and maintenances costs at wind farms range from 0.8¢ to 2¢/kWh and average 1.2¢/kWh.

The potential wind resource is not well documented. The California Energy Commission's *Wind Atlas* for California shows a few small areas of San Luis Obispo as having sufficient wind speeds to operate wind turbines. However, the high wind speeds are all noted in sensitive, scenic resource areas, and it is highly unlikely that these areas would be developed.

There may be other, less visually sensitive wind resource areas in the Salinas Valley, but specific sites have not been specifically identified. The low annual energy output of wind turbines have kept county residents from installing such facilities at this time.

Geothermal

Geothermal energy is natural heat generated deep inside the earth. This heat is released to the surface through fissures in the earth's crust (hot spots), which generally occur where the continental plates are colliding (as in California) or drifting apart. Hydrothermal systems are found where the hot spots associated with a magma extrusion are located near a region of permeable rock. Groundwater percolates down into the rock, is heated, and rises toward the surface (Fowler 1984). Locally, relatively cool hot water wells and springs can be found in scattered locations throughout the county. These naturally occurring hot spots indicate that there could potentially be other resources available.

There are no operating geothermal power plants within San Luis Obispo County. However, there are several businesses that do make use of the hydrothermal resources of the county. Sycamore Hot Springs and Avila Hot Springs (located along Avila Road north of Shell Beach) both have thermal wells and provide heated tubs, pools, and spas to their customers. Outside of Paso Robles, Aqua Futures catfish farm uses natural hydrothermal resources to heat its fish ponds.

The following pages contain a table which summarizes the characteristics of small energy facilities. The table provides information on the benefits of a particular technology as well as the constraints to development and environmental impacts.

Table 2-4: Summary of Small Energy Facilities
Characteristics and Issues

Resource	Production Technology	Time Fluctuations & Availability	Development Benefits	Development or Access Constraints	Environmental Impact Issues	Major Regulatory Issues
Solar Electric Systems	Photovoltaics (PV); solar thermal.	Daily and seasonal Storage systems are available.	Summer production (PV may be higher than solar thermal in spring and fall; for solar thermal—jobs. No air quality impacts.	May be blocked by structures or vegetation, power production must occur at resource site.	Aesthetic and safety concerns; removal of land for other purposes. In some areas: erosion and biological concerns. Solar thermal only: water use and chemical spills.	Assurance of solar access and rights, land use.
Solar Systems in Buildings	"Solar" heating, cooling, day lighting and water heating.	Daily and seasonally tuned to buildings needs.	Uses on site thermal resources and sinks; therefore needs no imported energy.	Knowledge of existing techniques.	Beneficial side effects are improved comfort and better lighting in the human environment.	Building and planning regulations. Title 24.
Biomass/ Waste-to-Energy	Direct combustion and cogeneration, indirectly following gasification and methane fermentation.	Some—seasonal; others—constant	Reduces waste disposal costs, extends seasonal jobs in agricultural and forest industries, extends landfill life, avoids or centralizes some environmental impacts.	Collection and transportation costs, waste ownership.	Harvesting forest residues; fuel transportation: traffic, pavement wear, and noise; facility-related: air quality and public health, waste disposal, and safety concerns; conflicting waste reduction and recycling objectives. In some areas: erosion, biological, aesthetic, public acceptance noise, disease and odor concerns.	Air quality regulations
Wind	Direct and mechanical wind turbine generators.	Daily and seasonally; typically highest production in summer.	Summer production, no air and negligible water quality problems, no water use, quick installation, jobs.	Few suitable areas in San Luis Obispo County, power production must occur at resource site.	Commitment of land to wind farms and compatible uses (especially grazing), wild and domestic animal disturbance, broadcast signal interference, aesthetic, bird kill, noise, safety, and erosion concerns.	Land use and environmental concerns.

Table 2-4: Summary of Small Energy Facilities
Characteristics and Issues

Resource	Production Technology	Time Fluctuations & Availability	Development Benefits	Development or Access Constraints	Environmental Impact Issues	Major Regulatory Issues
Hydroelectric	Hydraulic turbine generators.	Daily, seasonally, and annually.	No air quality impacts, opportunities for retro-fitting existing dams, canals, and pipelines.	Federal, state, and local permit approvals.	Undeveloped stream or river: hydrology, water quality, wildlife, fish, cultural resources, scenic and recreational opportunities, noise, safety and erosion issues. Retrofit: site-specific, probably limited and subject to mitigation.	FERC, water rights, and environmental concerns.
Geothermal	Direct and thermal steam turbine generators.	Seasonally and annually.	Some air and water quality problems.	Limited resource.	Groundwater contamination due to heavy minerals.	Environmental concerns.
Tidal	Hydraulic turbine generators.	Constant.	Significant environmental impacts and public concern.	Federal, state, and local permit approvals.	Wetland development, protection of sensitive species, economic activity of fisherman.	Corps, water rights, and environmental concerns.
Cogeneration	Sequential production of electrical and thermal energy. Fuel options.	Constant (except with some biomass); can vary to meet need.	Fuel-efficient, can be used with variety of resources, adaptable to existing facilities.	Fuel costs and availability.	Air quality and safety concerns. If biomass or coal fueled: ash disposal. In some areas: erosion, biological, aesthetic, and noise concerns, hazardous materials management.	Air quality regulations.

Source: Association of Bay Area Governments, *Small but Powerful*, 1987.
Crawford Multari & Starr, 1993.

Energy Costs

In 1991, San Luis Obispo County residents and businesses spent over $300 million purchasing energy. Table 2-5 and Figure 2-5 estimate the dollars spent on energy by sector. By saving only 4 percent of the energy purchased, approximately $12,500,000 could be saved by county residents and businesses. (A 4 percent savings is attainable through education programs alone.) Rebate programs can make energy efficiency and conservation programs very cost effective by off-setting the initial expenditure for these measures and can enhance the local economy.

Table 2-5: Dollars Spent on Energy
San Luis Obispo County 1991

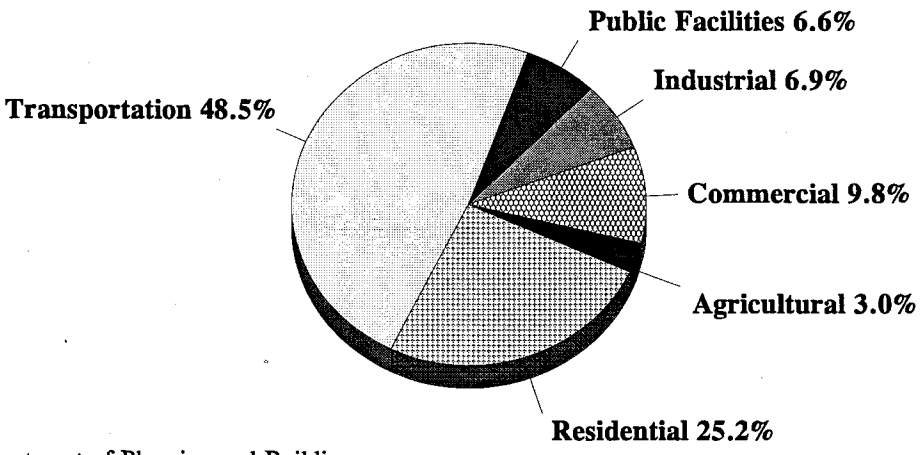
Sector[1]	Electricity	Natural Gas	Gas and Diesel[2]	Total Dollars[3]
Transportation[4]	$ 1,060,070	$ 33,600	$150,418,602	$151,512,272
Residential	56,799,995	21,973,336		78,773,331
Commercial	25,899,500	4,785,000		30,684,500
Industrial	14,064,820	7,519,200		21,584,020
Public	14,795,220	5,674,200		20,469,420
Agricultural	8,003,536	1,430,400		9,433,936
TOTAL	$120,623,141	$ 41,415,736	$150,418,602	$312,457,479

Source: California Energy Commission, *Quarterly Fuel and Energy Report for San Luis Obispo County*, 1992.
Notes: [1] The sales to various sectors is provided in Appendix B.
[2] Costs were calculated using estimates from Caltrans (in gallons) at an average rate of $1.20 per gallon.
[3] These numbers have been calculated using average rates for electricity, natural gas, and gasoline.
[4] Electricity and natural gas were used for lighting, office equipment, and administrative operations. Consumption could increase as more electric and gas-fueled vehicles are used.

Energy Use by Sector

Different sectors of the economy (e.g., residential, industrial, commercial) use widely different amounts and types of energy. Table 2-6 summarizes total energy use by each sector. Transportation is the largest sector (60 percent). The next largest sectors are residential (20 percent) and commercial (10 percent). Although manufacturing typically uses a greater percentage of energy in other cities and counties, San Luis Obispo has relatively few such businesses.

Figure 2-5: Energy Expenditures by Sector



Source: Department of Planning and Building

Table 2-6: Energy Use by Sector
San Luis Obispo County 1992

End Use By Sector	Total MMBtu	Percent	MMBtu Per Capita
Public Facilities	576,991	2.19	2.68
Residential	5,320,017	20.20	24.72
Industrial	1,306,722	4.96	6.07
Commercial	2,706,298	10.27	12.58
Agriculture	559,242	2.12	2.60
Transportation	15,873,057	60.26	73.77
TOTAL	26,342,327	100.00	122.42

Source: California Energy Commission, *Fuels Report (Appendix A)*, 1992.

Transportation

Transportation activities are one of the largest energy uses in the county (second only to electricity generation). Over 60 percent of the raw energy (Btu) brought into the county goes toward transportation. This includes trucks, automobiles, and buses. Even though California residents and businesses tend to use less electricity and natural gas per capita each year, energy used for transportation continues to increase. In San Luis Obispo County, per capita use has fluctuated in recent years, as shown in Table 2-7. On average, over half of the energy used in transportation is for passenger vehicles.

Table 2-7: Gasoline and Diesel Consumption per Capita
San Luis Obispo County 1988 to 1991

Year	Gasoline used (gallons)	Diesel used (gallons)
1988	556	77
1989	546	76
1990	560	77
1991	541	75

Source: California Department of Transportation, estimates, 1992.

Residential

The residential sector is the largest purchaser of electricity and natural gas in the county, using over 5,300,000 MMBtu. The energy is generally used for space heating, air conditioning, water heating, lighting, refrigeration, and cooking.

The residential sector purchased about 44 percent of the electricity consumed in the county. The per capita expense for electricity was $257, and the average electricity cost per household was $696.80 in 1991. The residential sector also used 35,671,000 therms of natural gas, which is 52 percent of the gas purchased in the county. The average cost for natural gas per household in 1991 was $269.56, and the average cost to each county resident was about $99 per year. Table 2-8 summarizes the per capita residential costs of electricity and natural gas.

Table 2-8: Average Per Capita and Household Residential Costs
San Luis Obispo County 1991

Energy Type	Total Cost	Per Capita Cost/year	Per Capita Cost/month	Household Cost per month
Electricity	$56,799,995	$257	$21	$54.18
Natural Gas	$21,973,336	$99	$8	$20.64
TOTAL	$78,773,331	$356	$29	$74.82

Source: California Energy Commission, *Quarterly Fuel and Energy Report,* 1992.
SLO County Department of Planning and Building, 1993, average household 2.58 persons.

Commercial

The commercial users of electricity and natural gas represent a broad range of businesses. The 235,450,000 kWh purchased by commercial businesses was split fairly evenly among food stores, eating and drinking establishments, hotels, and retail businesses. The rates for energy cost to commercial users vary depending on the amount of electricity used by a particular activity, but the average commercial rate is about 11¢ per kWh. This means commercial users spent approximately $25,899,500 purchasing electricity.

The commercial sector also purchased 7,975,000 therms of natural gas in 1991. Major users include eating and drinking places (34 percent) and hotels (31 percent). The next major user was personal services (9 percent), including businesses such as laundries, dry cleaning plants, beauty and barber shops, and linen supply services. The average commercial rate for gas in 1991 was about 60¢ per therm. This calculates to approximately $4,785,000.

Agriculture

In 1991, agricultural activities used approximately 6 percent of the electricity (68,996,00 kWh) and 4 percent of the natural gas (2,384,000 therms) in the county. The price per kWh was 11.6¢ for agriculture, which means a total of $8,003,536 was spent on electricity in 1991. Likewise, the cost of a therm of natural gas purchased for agriculture uses was approximately 60¢. This equates to an expenditure of $1,430,400. Energy is used for pumping water, cultivating fields, harvesting crops, applying fertilizer and pesticides, and providing heating and lighting for greenhouse and poultry operations.

Public Facilities and Institutions

The institutional purchasers of electricity and natural gas include health and legal services, postal services, educational facilities, government facilities, and correctional institutions. Institutional users of electricity bought 134,502,000 kWh in 1991. At 11¢ per kWh, the total cost was $14,795,220. The major users in this category include: schools and colleges—37 percent; health services, including hospitals, clinics, dentists, and nursing facilities—23 percent; prisons and jails—20 percent; and social services—5 percent. Local government operations used 3,195,000 kWh in 1991, accounting for about 2 percent of the consumption in this sector.

A total of 9,457,000 therms of natural gas was purchased by the institutional sector in 1991. The total cost at 60¢ per therm was $5,674,200. Schools and colleges used 37 percent, public order, justice and safety activities used 32 percent, and health service establishments used 20 percent.

Industrial

Electricity purchased for industrial uses is typically for activities such as oil and gas extraction, petroleum refining, electricity generation, pipeline operations, manufacturing, food processing, and sewage treatment. A total of 127,862,000 kWh of electricity was purchased by the

industrial sector in 1991. At a per kWh cost of about 11¢ in 1991, the industrial sector purchased an estimated $14,064,820.

A total of 12,532,000 therms of natural gas was purchased by the industrial sector. Almost all was used for oil and gas extraction processes such as enhanced oil recovery. At 60¢ per therm, approximately $7,519,200 was spent on natural gas in 1991.

Past Energy Use and Future Trends

Energy use per capita for electricity and natural gas has fluctuated somewhat over the years 1987 to 1991, as shown in appendix D. However, the patterns indicate that sales per capita are not increasing significantly each year, as was the case nationally in the 1960s and 1970s. Peak energy consumption continues to increase statewide. This is important because utilities plan for future supplies based on peak demand. A combination of energy awareness, conservation, and building efficiency programs appear to be maintaining a fairly consistent level of energy use.

Appendix D contains the actual sales of electricity and natural gas from 1987 to 1991 and then projects sales based on past use and population growth for the next twenty years. Similarly, the graph shows the actual and projected sales for natural gas.

The above projections are based on past use and population (more specifically kilowatt hours per capita and therms per capita). Because the model is based on per capita use, an increasing amount of electricity and natural gas are needed to support an increasing population. The model does not address 1) new uses of electricity that would significantly change the per capita consumption such as electric vehicles, 2) new businesses which may use large quantities of energy but do not represent an increase in population, 3) energy conservation programs (also called *demand side management* programs), or 4) energy efficiency improvements in buildings and appliances.

To maintain or decrease the current levels of electricity and natural gas use with an increasing population base, the per capita use of energy would have to decrease by a little over 2 percent each year (see Table 2-9). This means that a person using a total of 5.6 million kWh in 1993 would have to decrease use to 3.6 million kWh by 2015—an overall decrease of 37 percent. To achieve a 37 percent reduction, homes would need to be designed so that no electricity was required for space heating and cooling, and the efficiency of all refrigerators, lamps, and lighting fixtures would have to double (see Appendix B). If there is an increased reliance on electrical vehicles in the future, a 37 percent reduction in electrical use may not be possible.

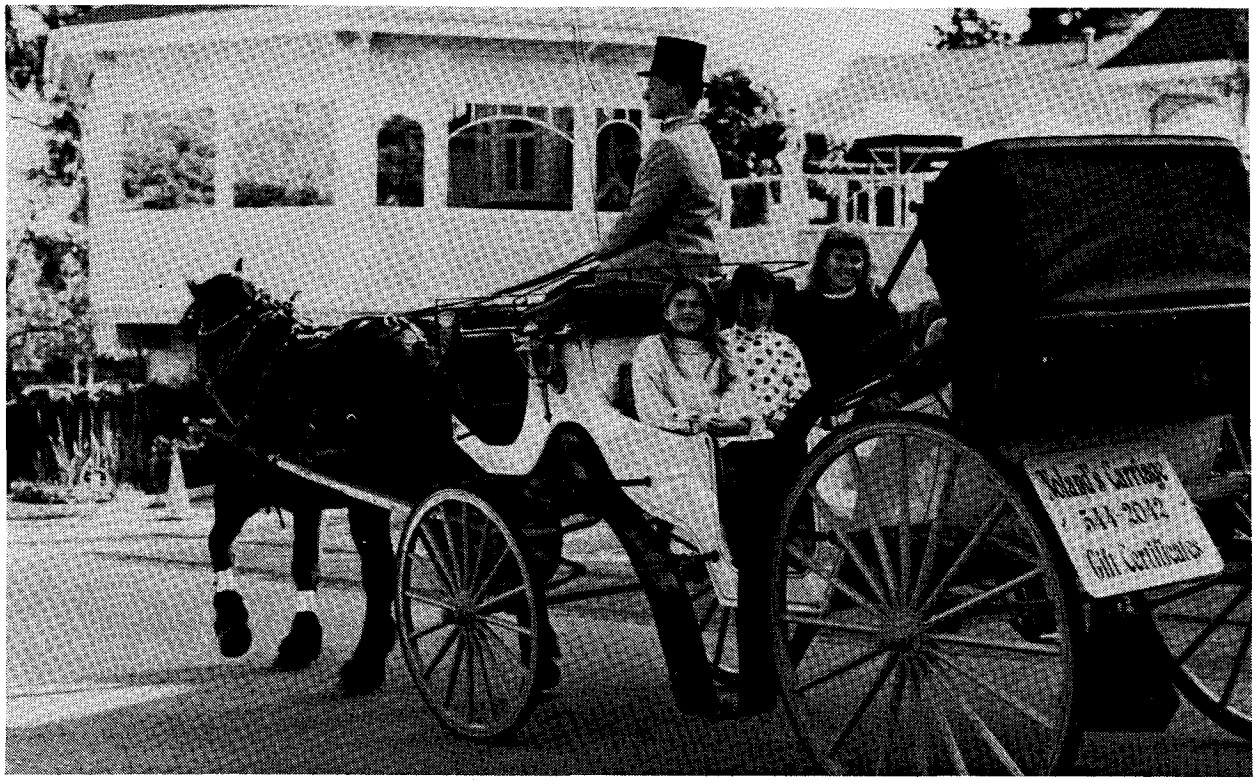
Likewise, in order to keep natural gas use constant, it would be necessary to reduce therms per capita from the 1993 level of 366 to 231 in 2015, and total MMBtu per capita would need to decrease from 56 MMBtu to 35 MMBtu (a 37 percent decrease). Designing buildings that do not require gas heating could reduce overall use by 46 percent (see Appendix B).

Table 2-9: Per Capita Electricity and Natural Gas Use
San Luis Obispo County 1993 to 2015

Year	Household Population	Electricity Use per Capita (kWh x 1000)	Natural Gas Use per Capita (therms)	MMBtu per Capita
1993	215,173	5,680	366	55.98
1995	226,643	5,446	351	53.68
2000	255,318	4,904	316	48.33
2005	283,994	4,416	284	43.47
2010	312,669	3,976	256	39.17
2015	341,344	3,580	231	35.32

Source: California Energy Commission, *Quarterly Fuel and Energy Report San Luis Obispo County*, 1992. Crawford Multari & Starr, 1993.

CHAPTER 3: CONSERVATION AND EFFICIENCY



This chapter identifies opportunities for county residents and businesses to use energy more wisely through conservation and efficiency programs. These ideas include:

- developing compact land use patterns,
- decreasing reliance on cars and encouraging more walking, biking, and riding the bus,
- constructing more energy efficient homes and buildings,
- ensuring that county facilities and operations are as energy efficient as possible,
- continuing to take advantage of energy saving opportunities in agricultural operations, and
- promoting recycling and reuse programs.

Most people have an intuitive understanding of the importance of energy conservation and energy—using less energy saves money—not only in costs associated with utility bills but also in other costs that are harder to quantify, such as environmental degradation from pollution or

resource depletion. The California Energy Commission estimates that efficiency programs started since 1977 have saved citizens $11.4 billion. The benefits of using energy wisely include improved air and water quality, less production of *greenhouse* gases (carbon dioxide and others that may contribute to global warming), and increased environmental quality. The issues involving energy conservation and efficiency include: land use, transportation, new building construction, building retrofits, public facilities, agricultural practices, energy education, recycling and reuse, and related economic impacts of conservation and efficiency measures.

Benefits of Energy Conservation and Efficiency

Energy efficiency and conservation reduces the need for additional power plants or other energy facilities that could cause undesirable environmental effects as mentioned in the introduction. Business profits will be greater if business energy costs are reduced (all other factors held constant), and residential energy customers will have more disposable income to spend for non-energy purposes if their energy costs are reduced. Many energy saving measures are inexpensive and have a short payback period. Some require a larger capital investment than others. The following table estimates the cost, savings, and payback periods for several measures:

Table 3-1: Economics of Various Conservation Measures

Measure	Added Cost	Annual Savings on heating bill	Annual savings on cooling bill	Payback time on investment
Insulate Attic	$300-450	$50-75	$33-67	3.1-3.5 yr
Insulate hot water heater	$10-20	$10-40	n/a	6 months-1 yr
Adjust thermostat 68^0	none	$13-53	$7-20	Immediate
Low flow showerhead	$7-17	$25	n/a	4-6 months
Clotheslines	$5	$15-20	$3-5	1-6 months
Caulk and weatherstrip	$75-105	$40-100	$27-67	6 months-1 yr

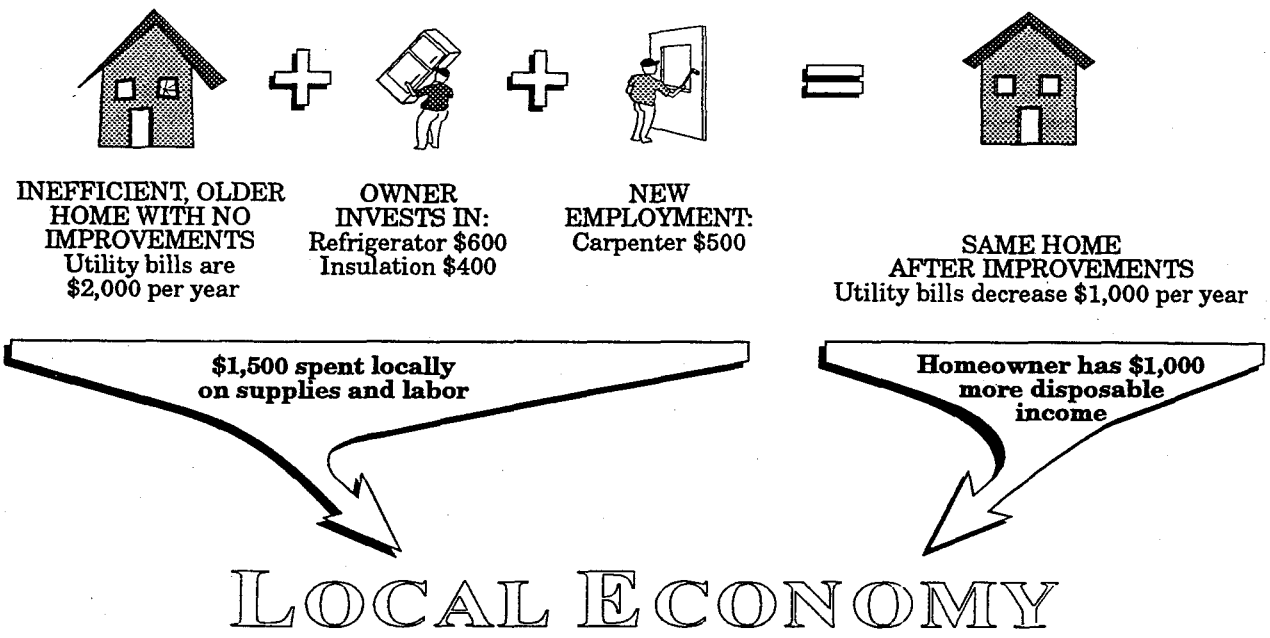
Source: Pacific Gas & Electric, The Energy Planner, 1992.

The local and regional economy can also benefit from the money spent on home or business improvement projects to increase energy efficiency. To illustrate this concept, assume that an owner of an older home in San Luis Obispo County (with no insulation, drafty windows, and older appliances) spends as much as $2,000 a year on utility bills. By spending $400 on

insulation, $600 on a new refrigerator, and $500 on a carpenter to repair the windows and doors, the homeowner could reduce the annual utility bills by half.

Also, while the homeowner has spent $1,500 on supplies and labor, the resulting total activity in the local economy is $3,000 (see Figure 3-1). (If we assume that the local multiplier is 2.0[2].) After 18 months, the homeowner lives in a more comfortable home, has saved $1,500 on utility bills, and paid back the initial investment. Each subsequent month, the homeowner spends less money on utilities and has more disposable income to purchase goods and services in the local economy.

Figure 3-1: Local Multiplier Effect



Source: Crawford, Multari, & Starr, 1994

[2] The term "local multiplier" is used to describe the situation in which each dollar spent locally is, at least in part, *re-spent* locally. The proportion of an expenditure that is re-spent varies widely according to the type of expenditure. Most economic studies use multipliers ranging from 1.5—which assumes that 33¢ of each dollar is re-spent locally—to 2.78—which assumes that 64¢ of each dollar is re-spent locally (Reiner, 1991).

Although a residential example is used above, the same type of benefits will also result from commercial, industrial, and governmental retrofits. Money saved on public sector utility bills can be available for new or enhanced governmental services.

Improving Energy Conservation and Efficiency

Both the public and private sectors have a variety of ways through which they can cause or encourage reductions in energy use. Local governments can work toward community-wide improvements in energy conservation and efficiency through land use planning policies and regulations, the management of the transportation system, buildings and energy use, increased efficiency of public facilities, agricultural practices, energy education, and recycling and reuse programs. By saving energy through more efficient construction and operation of commercial and industrial facilities, businesses will have more capital and profits will increase. The potential for savings is great because such facilities may use large amounts of energy for manufacturing processes, space heating or cooling, refrigeration, and lighting.

The remainder of this chapter details various energy conservation and efficiency measures and provides policies and programs to guide county action.

Land Use

Land use strategies for saving energy include: compact urban form, multi-modal transportation-oriented development, increased solar access, providing for mixed land uses, and energy conservation through landscaping.

As new residents move into the unincorporated areas of the county, the location of new homes in relation to jobs and services will have a significant impact on energy use. The location of different land uses in relation to one another can obviously affect travel distances and the mode of transportation people are most likely to use (walking, bicycle, car, transit, etc.). Different land uses also generate varying amounts of traffic; a day care center will generate more trips than a single-family home.

Compact Urban Form

Building compact housing (more homes on less land) and diverse housing (a mixture of single-family homes, duplexes, townhouses) can increase the energy efficiency of a community as well as help address issues related to housing, air quality, open space, farmland preservation, traffic congestion, etc.

A compact urban form provides urban services to concentrated areas of residences and commercial or industrial business. In general, compact development can be achieved by encouraging infill development more economically. Likewise, subdivisions that are adjacent to the existing community boundaries should be encouraged over those that are far from community centers.

Drive Less, Walk and Ride More. Compact urban form can increase opportunities for residents to complete shopping and other chores without driving or by driving shorter distances. People are most likely to walk rather than drive if their destination is within one-quarter mile (Calthorpe, 1992). If more people were to walk or ride bikes for short trips, gasoline use would decrease, air quality would improve, and less energy would be used to build and maintain parking lots. Concentrating the density of residential and commercial development, can also facilitate the provision of transit services to an area by increasing convenience for households.

Locate Jobs and Housing. The home-to-work trip accounts for about one-third of all private vehicle trips in a typical urban area. In rural areas the ratio is even higher. The length and location of these trips is an important factor in determining the type of transportation alternatives available to the commuter and the quantity of air pollutants generated. There are two principal approaches to reduce the number of commute vehicle trips.

1. One solution is to locate jobs and housing in proximity to one another. There are some inherent problems in this approach. One flaw is that most family households have two workers, and both workers may not find employment in the same community. Also, some people may choose a housing location distant from their job because factors other than proximity attracts them. Locally, some people who work in San Luis Obispo choose to live in Atascadero because they prefer the climate and countryside of the north county. Another challenge is to ensure that the jobs/wages and housing affordability are matched.

2. The second method of reducing commuter vehicle trips is to concentrate jobs in a few locations in the county. This makes it more cost effective to provide mass transit and carpooling to those areas. With faster, cheaper mass transit options, more people are likely to use the service.

The county continues to develop a mass transit system to meet the needs of a population that is located over a large geographic region. Because less expensive housing continues to be located in the northern and southern portions of the county while many of the jobs are located in the central portion of the county, many people commute relatively long distances to work. This leads to increased vehicle trips, gasoline consumption and air pollution. One goal of the *Energy*

Element is to encourage residents to use transit systems and other energy efficient transportation options (see following discussion on transportation). By promoting a better balance between available jobs and housing, the total vehicle miles traveled can decrease.

Reduce Utility Service Lengths. Finally, compact urban form can decrease energy use by reducing the length and width of roads and/or utility service connections in new development. By reducing the size of lots in developed areas, the physical length of roads and utility service lines and the amount of energy used to construct the roads or lines (pipelines, electrical lines, etc.) are reduced. The gasoline used by Sheriff, police, fire, and other county services in such areas is also reduced.

Narrowing street widths reduces the amount of pavement used to construct the roadway, and it has the added benefit of reducing the energy used during the summer to cool buildings. Pavement surfaces act as solar heat collectors in the summer. This increases the air temperature near those surfaces and creates greater demand in nearby buildings for air conditioners, fans, coolers, etc.

Although the short-term energy savings may not be significant, land use planning techniques can produce major savings in long-term energy use as development and redevelopment continue. The real monetary savings will come in 10 or 20 years when county communities do not have to build a new sewer plant, enlarge a water distribution system to supply a remote rural subdivision, or add lanes to county roads and subsidize a bus system because of traffic congestion.

Compact development can also reduce pressures for the conversion of agricultural lands. Given the valuable agricultural lands found in San Luis Obispo County, the benefits of saving agricultural land in viable production are enormous.

Alternative Transportation-Oriented Development

Development patterns that facilitate pedestrian, bicycle, and efficient transit can be effective in reducing energy use. One component is to provide for mixed land uses.

Table 3-2: Proximity to Transit Stops and Frequency of Use

10% of residents use transit to commute if they live less than a 1/4 mile from a stop
4% of residents use transit to commute if they live 1/4 to 2 miles from a stop
Less than 1% of residents use transit to commute if they live 2+ miles from a stop.

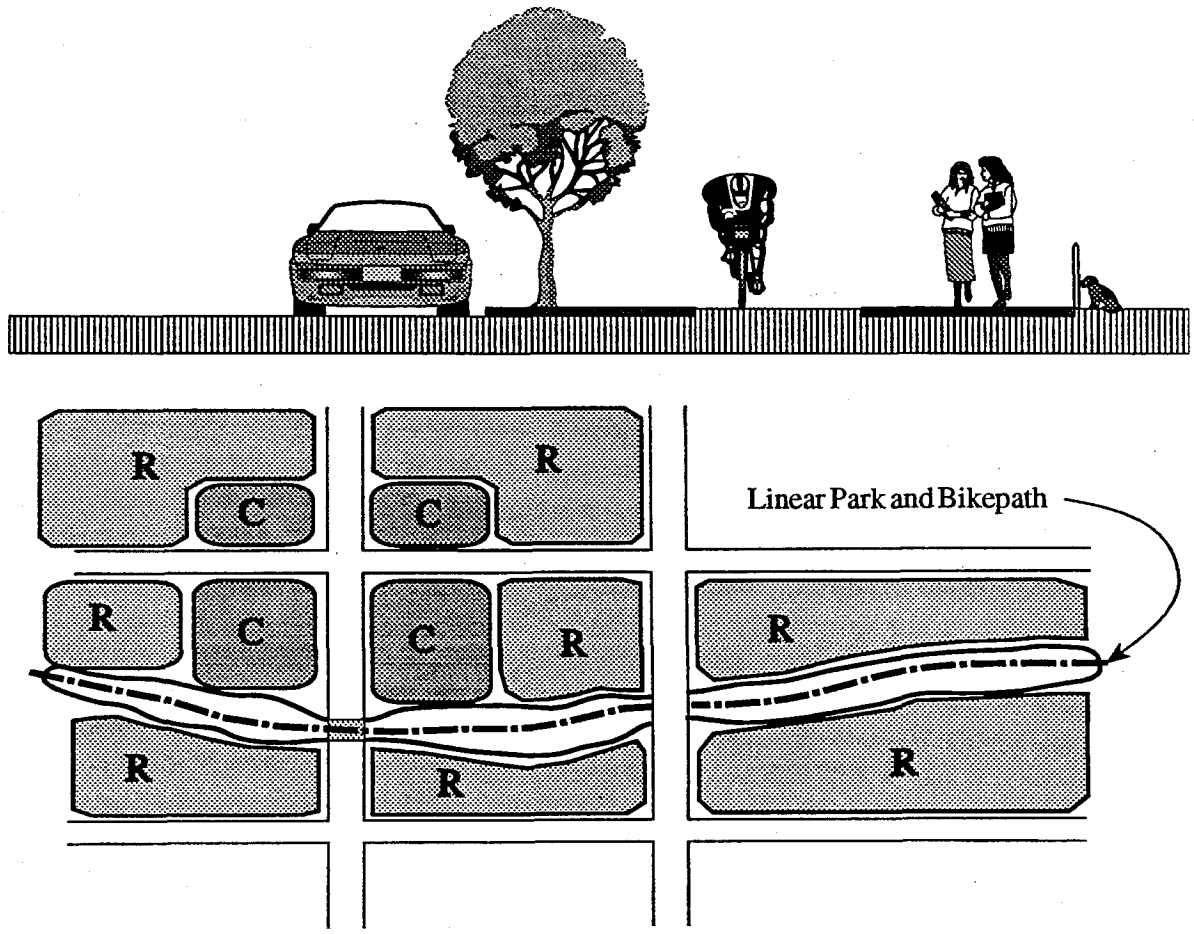
Source: Air Resources Board, 1993

Provide for Mixed Land Use. In the days before widespread auto use , city dwellers often lived closer to where they worked, used public transportation, and bought groceries

and conducted household business within their neighborhoods. With the advent of the street car system (and later the automobile), housing began to spread further from areas of employment and commercial services. As a means of reducing miles traveled, communities should allow a mixture of land uses that enable people to walk or bicycle to work or to purchase necessary household items at locations convenient to their neighborhood.

Mixed land use is also a strategy for achieving compactness in urban development. While conventional zoning typically results in the spatial separation of different land uses, mixed use recognizes that some land uses are functionally compatible with one another and need not be physically separated. A common form of mixed-use development is a ground level commercial use with residential uses above.

Figure 3-2: Separated Bicycle and Pedestrian Paths



Source: Crawford Multari & Starr, 1994.

Compact urban form facilitates alternative transportation opportunities, but there are additional land use strategies that can be employed to further increase walking, biking, and transit use (See Figure 3-2).

As mentioned above, people are most likely to walk rather than drive if their destination is within one-quarter mile. This means that land uses should be carefully planned to complement adjoining uses. For instance, schools, day care services, dry cleaners, and convenience stores can all be located near transit stops or near large residential concentrations.

Another example for designing communities is the Radburn concept which incorporates ideas of compact, limited sized towns with internal walkable greenbelts. The Radburn concept calls for integrated parks that are connected with a system of paths. A major purpose of this design is to decrease pedestrian conflicts with the automobile.

People are also more likely to walk or ride bicycles where bike paths or sidewalks are separated from streets. When physically possible and financially feasible, separate bike or pedestrian paths should be established away from busy streets and intersections. Incorporating such features into a linear park are often very effective. The City of Davis, California is an example of a community with an extensive bicycle path system. A recent study of the resident's travel patterns found that 22 percent of the employed people surveyed typically ride their bike to work. 43 percent of students rode to school. In comparison, bicycle trips comprise less than 2 percent of travel in the Sacramento metropolitan region. The large use of bicycles in Davis illustrates the importance of safe facilities and the proximity of residential areas to commute destinations in encouraging higher rates of bicycle travel.

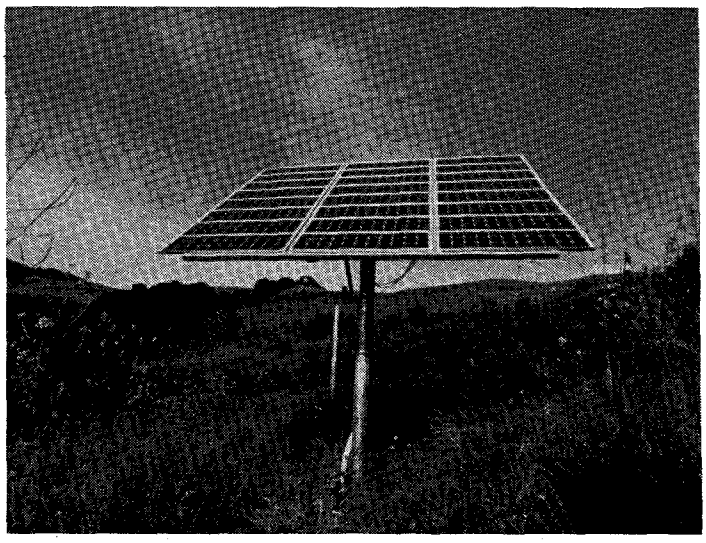
Pedestrians generally do not like walking between cars or crossing multiple-lane intersections; overhead or tunnel crossings can be used to further encourage walking near busy arterial roadways. For downtown streets, curb bulb-outs allow pedestrians to walk shorter distances in crossing streets. Walled residential communities actually encourage automobile use. Because there are no through-streets, pedestrians or bicyclists must take a circuitous route to get where they are going. Often, they will opt to take a car instead. These concepts are illustrated in the programs that follow this discussion.

Nationwide, 38 percent of all vehicle trips are for shopping or personal business. One half of these trips are less than five miles in distance. If the distance were shortened and half the trips were made on foot, total vehicle trips would lessen by over 5 percent.

One survey of suburban office workers found that about half left their building during the day. In an area with mixed-use, high-density development, 25 percent of trips were made on foot compared to 6 percent where services were not easily available. Using these figures, about 38 vehicle trips per day would be eliminated for a 100,000 square foot office building with 400 employees, if shops and services were within walking distance. This translates to about 2,500 gallons of gasoline saved each year (CEC,1992).

Increase Solar Access

Another way in which land use planning can reduce energy use is through subdivision designs that encourage solar access to buildings. Having sufficient solar access reduces the energy used for hot water heating and heating and/or cooling residences. Subdivision layouts should encourage lots with large southern exposures, which is the optimal siting for an energy efficient home. This topic will be discussed more in the section on *Buildings and Energy Use.*



Energy Conservation through Landscaping

Planting trees along streets reduces the heat absorbed by pavement and can therefore reduce the energy needed for cooling in adjacent buildings. Street trees also provide a more attractive environment for walking and bicycling and can increase property values.

Trees can not only help to cool the pavement outside homes and buildings, but can also be used to keep direct sun from entering buildings through windows (see the section on *Building and Energy Use* for more information). Plant leaves can block about 80 percent of the heat from summer sun that enters windows. The effective selection and placement of shade trees not only reduces carbon dioxide buildup, increases property value, and enhances community aesthetics, but shade trees also reduce air conditioning needs, especially in climates like the north county area which tend to be much greater. The use of deciduous shade trees provide further benefit in that sunlight will be able to reach the buildings in the wintertime, thereby reducing wintertime heating needs.

Definition of Goals, Policies, Guidelines, and Programs

The policies and guidelines in this document are intended to serve as an educational resource for projects that require only ministerial approval. For discretionary projects, projects that need a public hearing, the element provides guidance and a range of alternatives for achieving the stated goals.

The goals, policies, guidelines, and programs contained in the *Energy Element* provide the foundation for reviewing energy related projects for consistency with the general plan. They also provide guidance for incorporating energy conservation and efficiency measures into other development projects. The following definitions identify the differences between a goal, policy, guideline, and program:

Goal

Goals are a general expression of community values, an ideal future result, or condition, related to public health, safety, or general welfare. Goals provide the vision statement of *what* is desired in the future.

Policy

Policies are more specific than goals. Policies are statements that guide decision making. Policies are based on the information gathered and analyzed during the process of developing the element.

Guideline

Guidelines provide direction on *how* to implement the goals and policies contained in the general plan. While guidelines may provide specific direction for addressing a particular issue, alternative approaches that achieve the same result may also be used.

Program

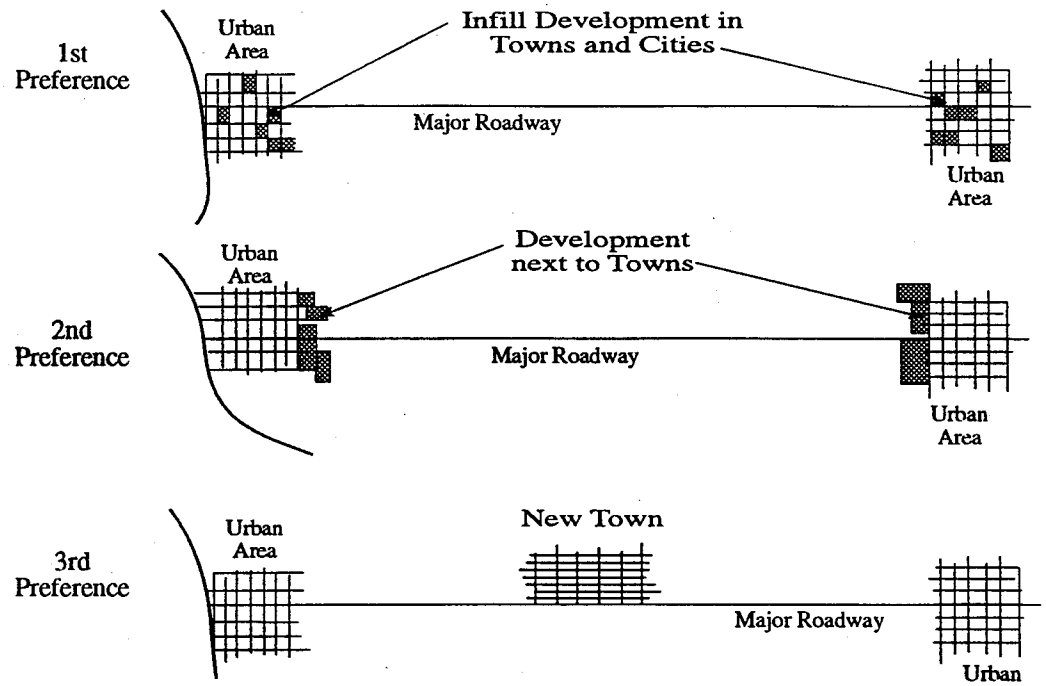
Programs are actions that may be initiated by the county or other public agencies to achieve specific community objectives. Because programs are recommended actions rather than mandatory requirements, county implementation should be based on consideration of community needs, support for the program, its related cost and available funding.

I. Goal: Develop Compact Communities

Policy 1. Encourage energy efficient land development by promoting compact, residential areas and commercial service cores and non-vehicular linkages between them. Concentrate new growth within existing communities, emphasizing services, so that individual communities become more complete, diverse, and balanced. Allow multi-family housing in and near downtowns, neighborhood commercial centers, and mixed use developments. Isolated and remote residential development projects shall be discouraged (see Figure 3-3).

> **Guideline 1.1.** Infill development and expansion of existing developed areas into adjacent undeveloped areas is preferred to new development in remote, undeveloped locations. Infill development should be within any urban reserve and village lines

Figure 3-3: Preferred Urban Development Patterns



Source: Crawford, Multair, & Starr, 1994

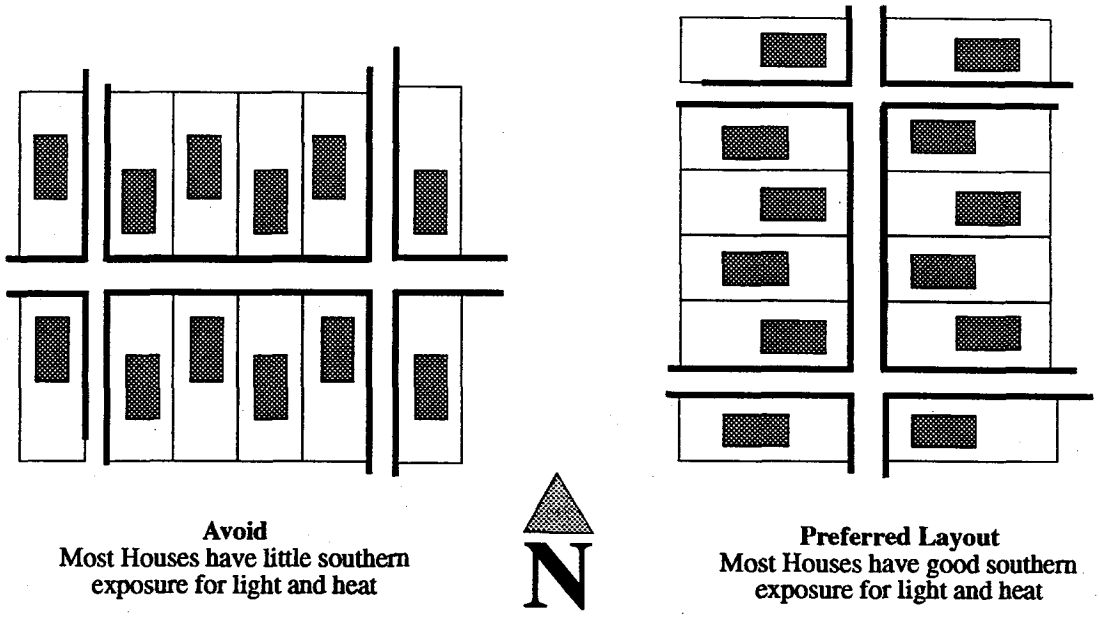
designated in the *Land Use Element*. The second preference is for expansion of the existing urban areas in the county to meet remaining demands. Concurrent expansion of commercial land uses should be encouraged to enable the unincorporated areas to become full-service communities.

Guideline 1.2 Figure 3-4 provides an example of how a site might be designed for proper solar access. (A more detailed example of energy efficient land use patterns can be found in Appendix B of the *Conservation and Efficiency Working Paper*.) Note that "subdivision" applies to residential as well as commercial, office, or industrial areas. The following criteria should be considered prior to approval of a subdivision application:

a) Provide a network of interconnected neighborhoods or areas. Discourage continuous walls which prohibit pedestrian access. Offset berms to control privacy and noise are encouraged where applicable.

b) Employ narrow automobile travel lanes, traffic calming measures, energy efficient exterior lighting, street trees, and pedestrian and bicycle paths where applicable.

Figure 3-4: Sample Subdivision Design for Solar Access



Source: Crawford Multari & Starr, 1993.

c) Design the site such that convenient and accessible sites for existing and future transit stops are available consistent with approved transit and circulation plans.

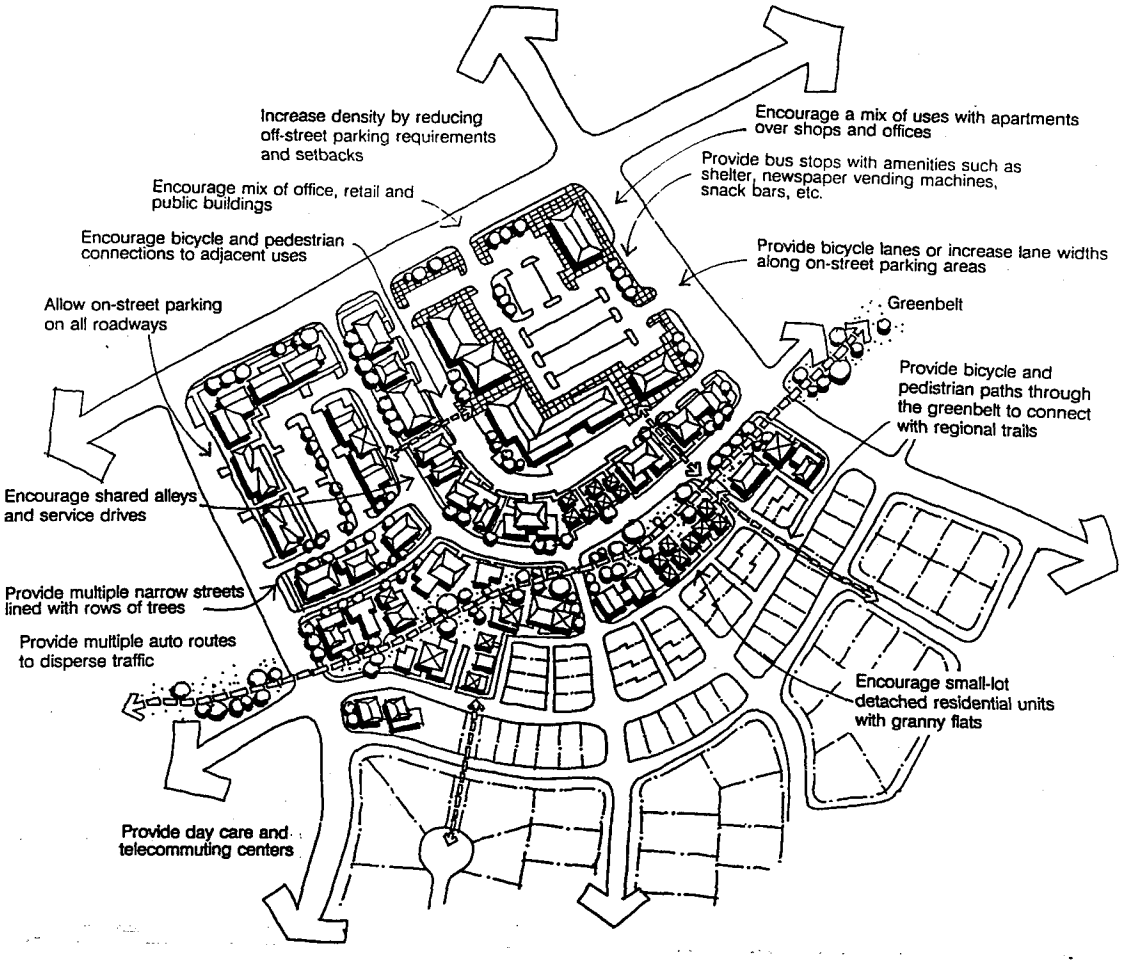
d) Consider sufficient setbacks and orientation to maximize solar access to all homes. Flexible frontage and setback requirements will allow building sites with larger yards on the south side of structures for better solar orientation.

e) Locate pedestrian ways and bicycle paths to reduce conflicts among motor vehicles, pedestrians, and bicyclists. Alleys could be considered where appropriate.

f) Provide street trees at regular intervals along pedestrian and bike pathways. A landscaping plan should identify species and locations.

g) Where appropriate, sidewalks or trails should be provided on at least one side of the road, have adequate clearance and be well lit with energy

Figure 3-5: Example of a Walkable Subdivision Design



Source: The Planning Center, as adapted by the Department of Planning and Building

efficient lighting for safety reasons.

h) For land divisions larger than 100 units, provide opportunities for neighborhood shops and services. The project should provide for a convenient mix of uses by locating housing, commercial and office buildings, industry, schools, and day care services in proximity. Transit access should be available throughout the development. (Figure 3-5 illustrates methods of subdivision design that can encourage walking and bicycle riding.)

Program 1.1. Adopt a Planned Development ordinance to encourage creatively designed land use projects which may use standards differing from the conventional standards of the Land Use Ordinance.

Program 1.2. Review road standards to ensure that all streets proposed with new subdivisions are designed with the minimum pavement width and curb radii feasible, considering projected traffic flow, possible traffic calming measures, parking requirements, safety, cost and energy efficiency.

Program 1.3. Examine land use in existing residential areas and make recommendations for changes as part of the *Land Use Element/Local Coastal Plan* update process that will facilitate locating neighborhood shops and services within walking distance of homes and along transit corridors.

Policy 2. Encourage the concentration of new residential development in higher density residential areas located near major transportation corridors and transit routes. Public facilities, commercial areas, and schools should be grouped into pedestrian and bicycle-accessible core areas that provide a focal point to the community and promote public transit.

Policy 3. Locate new community commercial centers near major activity nodes and transportation corridors. Community commercial centers should provide goods and services that residents have historically had to travel outside of the community to obtain.

Design new commercial development to encourage and facilitate pedestrian circulation within and between commercial sites and nearby residential areas rather than being designed solely to serve vehicular circulation.

Policy 4. Promote new commercial development in rural communities that provides for the immediate needs of the local residents.

Policy 5. Encourage new office development to locate near major transportation corridors and concentrations of residential uses. New office development may serve as buffers between residential uses and higher-intensity commercial uses.

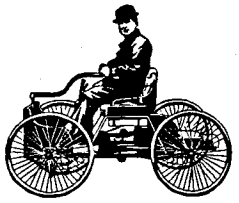
Program 5.1. Recommend that the Council of Governments continue with a program to monitor and encourage an enhanced jobs-housing balance in San Luis Obispo County. The jobs-housing balance refers to the jobs and associated wages available in the county compared to the availability of affordable housing for those wage earners. The monitoring program should consider including the following elements:

- Annual changes and five-year trend lines for the number of jobs and number of housing units and, if available, workers per household.
- Annual changes and five-year trend lines for household incomes compared with the median prices and rents of housing.
- Changes in the transportation system or related communications technologies that would significantly affect current reliance on automobile commuting.

- Data from incorporated cities should be included in the analysis of changes and trends. The county should coordinate with the Council of Governments and participate in the jobs-housing study.

Policy 6. Promote use of first floor space in commercial centers for retail, food service, financial institutions, and other high-volume commercial uses. Encourage residential uses in the upper floors of commercial buildings.

Transportation



Forty-eight percent of all the energy used in California is for transportation, and personal vehicles account for over 50 percent of all transportation energy use. Since 1973, transportation is the only energy use sector in which consumption has continued to grow in California (CEC, 1993). Energy conservation strategies for transportation attempt to decrease energy use through a variety of means.

The transportation programs discussed in this chapter can reduce vehicle fuel use by encouraging more people to walk or ride bicycles, use public transit, improve vehicle efficiency, use the railways rather than driving or trucking, use pipelines rather than boats, use telecommunication rather than driving or mail, reduce street widths, and plant trees. The overall objectives are to reduce the amount of fossil fuels that are burned and increase the efficiency of our transportation system.

Bicycles

Bicycles provide an energy efficient, clean, and inexpensive (relative to automobiles) form of transportation. Unfortunately many people do not use bicycles for transportation for several reasons, including but not limited to: 1) there may be no place to secure the bike when shopping or working, 2) streets are too narrow or dangerous for bicycles to share the roadway with automobiles, 3) there are not showers and/or lockers available to allow a cyclist to change clothes after a long ride, 4) inclement weather may make biking uncomfortable or dangerous, 5) some trips such as weekly shopping may require carrying amounts or sizes of objects that are difficult to handle on a bicycle, or 6) for age and health reasons. Because of the long distances between bedroom communities and employment areas in San Luis Obispo, it is unlikely that bicycles will replace a significant number of automobile trips. If new job opportunities become concentrated within existing county communities, more residents will be able to walk or ride bikes.

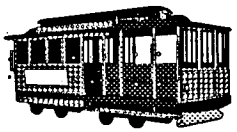
The County Bikeways Plan identifies needed bikeway routes, accessory facilities such as bike parking, educational programs, and potential funding sources. The plan describes existing conditions in the county, the classes of bikeways and route selection process, and how bikeways

fit into the transportation system among other issues. The County Bikeways Plan is available from the county Engineering Department.

The San Luis Obispo Council of Governments' 1994 *Regional Transportation Plan* recognizes bicycles as an important component of the regional transportation system. One goal of the plan is to provide a safe and efficient regional bikeway system that promotes bicycling as a means to decrease auto-dependency, air and noise pollution, and traffic congestion. Policies in the plan deal with issues such as: creating new and/or improved bike paths or travel lanes; educating riders on suggested routes and safety; providing bicycle safety programs; promoting *Bike and Ride* services by providing bike lockers at appropriate sites; funding local bicycle facility improvement programs; creating *bicycle fleets* for use by employees during work hours; and establishing recreational bicycle paths.

Passenger vehicles and light-duty trucks use a combined average of 28,414 gallons of fuel each day in 1992. If bicycle and pedestrian trips could replace only 5 percent of the trips each day, this could result in a savings of up to 1,421 gallons. Total savings in San Luis Obispo County would be $1,705 a day and over $600,000 a year (assuming $1.20 per gallon of gas).

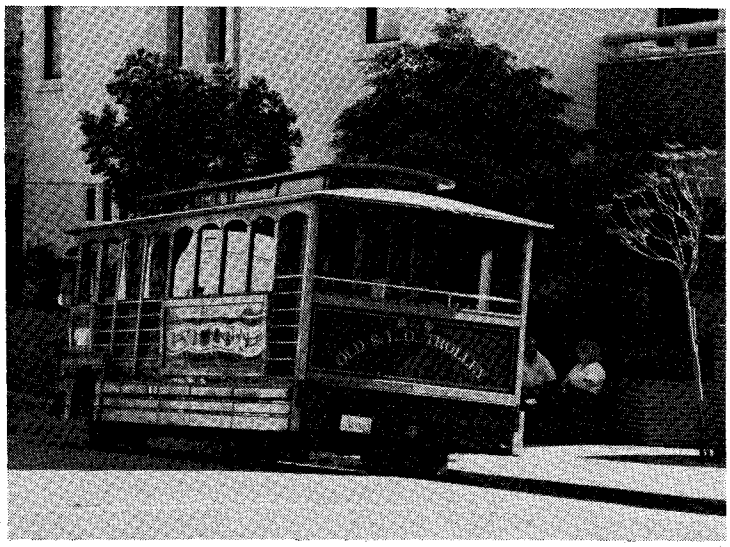
Public Transit



Public transit is often viewed as a key component in reducing vehicle trips in and among cities. Mass transit and carpooling require certain population densities before they become feasible. A density of 12 dwelling units per acre is considered the minimum necessary to support bus routes (Calthorpe, 1990). Although an extensive public transit system is not available to residents outside of the City of San Luis Obispo, the county should consider present and future transportation needs in all planning efforts. For example, Paso Robles recently started transit service to downtown and other shopping centers.

Public transit needs will increase over the next 20 years as population increases. In particular, increased traffic volumes on the Highway 101 corridor between Paso Robles and Arroyo Grande will probably generate sufficient demand to support a bus line with the City of San Luis Obispo as the main hub. Incentives that may increase transit ridership include;

- make more routes to various destinations available,
- lower fees and costs to use transit systems,
- promote public transit through marketing and education,
- develop a rider friendly system with understandable schedules, comfortable transit stops and clear signage, and
- provide transit subsidies through employers and public agencies.

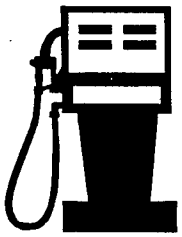


The Regional Transportation Plan recognizes public transit as a link that enables individuals to travel using a variety of modes that minimize automobile dependence. A goal of the plan is to provide reasonable and accessible region-wide public transit services to meet the mobility needs of all residents for access to essential services, educational, recreational, and employment opportunities, and as a means to reduce air pollution, traffic congestion, parking problems, and fossil fuel use. Policies are focused on maintaining a minimum level of service; increasing convenience where feasible and cost effective; reducing air pollution, reducing cost where possible, and maximizing input from individuals, jurisdictions, and groups on all aspects of transit planning, evaluation, and service evaluation.

Vehicle Efficiency

Two critical aspects of vehicle efficiency that can be influenced by the county and the private sector include idling cars and older cars. Cars are least efficient when idling because they are consuming fuel at zero miles per gallon. Older and improperly maintained vehicles are not fuel efficient and pollute more than newer vehicles.

Alternative Fuels



Propane, methanol, ethanol, compressed natural gas, electric, and hydrogen powered cars are viable alternatives to traditional gasoline powered vehicles. New information about evolving fuel technologies will be available in the future. The following discussion highlights some of the features, advantages, and disadvantages of these vehicle technologies.

Propane. Propane is an alternative to gasoline for operating automobiles and trucks. It is cost effective to retrofit vehicles to enable them to use propane. Propane provides a travel range comparable to gasoline. It is more available and easier to handle than natural gas and reduces maintenance costs because it burns more efficiently.

Methanol. Often referred to as wood alcohol, methanol is commonly used as a blend of 85 percent methanol and 15 percent unleaded gasoline. Vehicles operating on methanol fuel can reduce emissions up to 50 percent relative to their gasoline counterparts. In addition, toxic emissions can be reduced by 50 percent (CEC, 1993).

Ethanol. Ethanol, or grain alcohol, is a high-octane fuel derived from corn and other biomass products. Ethanol is often used as a gasoline additive to boost octane. While this fuel has not been developed to the extent of methanol fuel, it can be produced from renewable resources, such as corn and other grains.

Compressed Natural Gas (CNG). Natural gas is the cleanest burning and currently least expensive fossil fuel for transportation. CNG vehicles can reduce carbon monoxide emissions by over 90 percent and organic gases by 35 to 45 percent. Natural gas is more readily available than other alterative fuels because of the extensive network for serving homes and businesses. Utilities are installing natural gas fueling stations in many parts of the state and several auto manufacturers are offering natural gas vehicles. The range for dedicated natural gas vehicles averages 200 miles (CEC, 1993).

Hydrogen. Hydrogen may also be an energy source for the future. It is a clean, efficient, plentiful alternative to carbon based fuels like oil and coal. Hydrogen can be made from several sources. Each molecule of water contains two atoms of hydrogen that can be extracted, stored, used as fuel and returned to the environment as pure water. Hydrogen can also be derived from natural gas and plant material. It can be used in internal combustion engines or combined with oxygen to power fuel cells to produce electricity. Barriers such as cost, safety, and lack of a distribution system are slowly being addressed through demonstration projects.

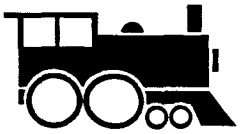
Electricity. Electric vehicles do not produce tailpipe emissions; they provide pollution reductions over gasoline vehicles even when the power plant emissions from generating electricity are considered. Electric vehicles are cost effective for short commutes, although long distance travel is still limited (about 60 miles). There are also some questions about the health effects of the electric and magnetic fields present in electric vehicles. Also, electric cars will increase the use of electricity. If electric cars create a large demand, this could lead to more powerplants being built.

Fuel Cells. Fuel cells are an experimental technology that uses a chemical process (similar to a battery) to produce energy. A fuel cell requires a continuous supply of hydrogen and oxygen. Hydrogen can be supplied either directly by an on-board hydrogen tank or indirectly by an on-board fossil fuel supply and reformer. A hydrogen fuel cell vehicle would have an energy efficiency about 160 percent greater than that of an internal combustion engine. For fuel cells powered by fossil fuel with on-board reformers, the only major emission would be carbon dioxide—at about 70 percent relative to gasoline powered cars. All emissions (both tailpipe and those used to create the hydrogen) could be eliminated if the hydrogen was generated from solar or wind energy.

Passenger and Commodity Railway Services

Trains provide a very energy efficient mode of transportation for both people and goods. The AMTRAK *Coast Starlight* provides a total of two stops per day within the county, both in the City of San Luis Obispo. Despite this relatively limited rail service, the *Coast Starlight* attracts

heavy use from San Luis Obispo residents; an average of nearly 125 passengers board or depart on the two runs each day.



Local commodity movement on rails has declined because of an increasing emphasis on boat and truck shipping and centralized distribution facilities. Thus fewer and fewer industries continue to receive boxcar deliveries. In San Luis Obispo, trucks offer a faster and more flexible method of shipping goods, but trucks also consume more fuel and create greater demands on roadway improvements. The number of freight trains traveling through the county has remained fairly constant at two daily in each direction.

Over 1.75 million gallons of fuel (gasoline and diesel) are purchased each year in San Luis Obispo County to operate heavy trucks. If only 5 percent of the shipping was switched from trucks to railways, over 87,500 gallons of fuel could be saved each year. If the average fuel cost per gallon were $1.30, the total savings would be over $100,000 annually. Given the same amount of load and same travel distance, trains are four times (75 percent) more efficient than trucks (Jackson, 1991).

It should also be noted that some rail rights-of-way have been converted into trails. More information about this program is available from the Council of Governments.

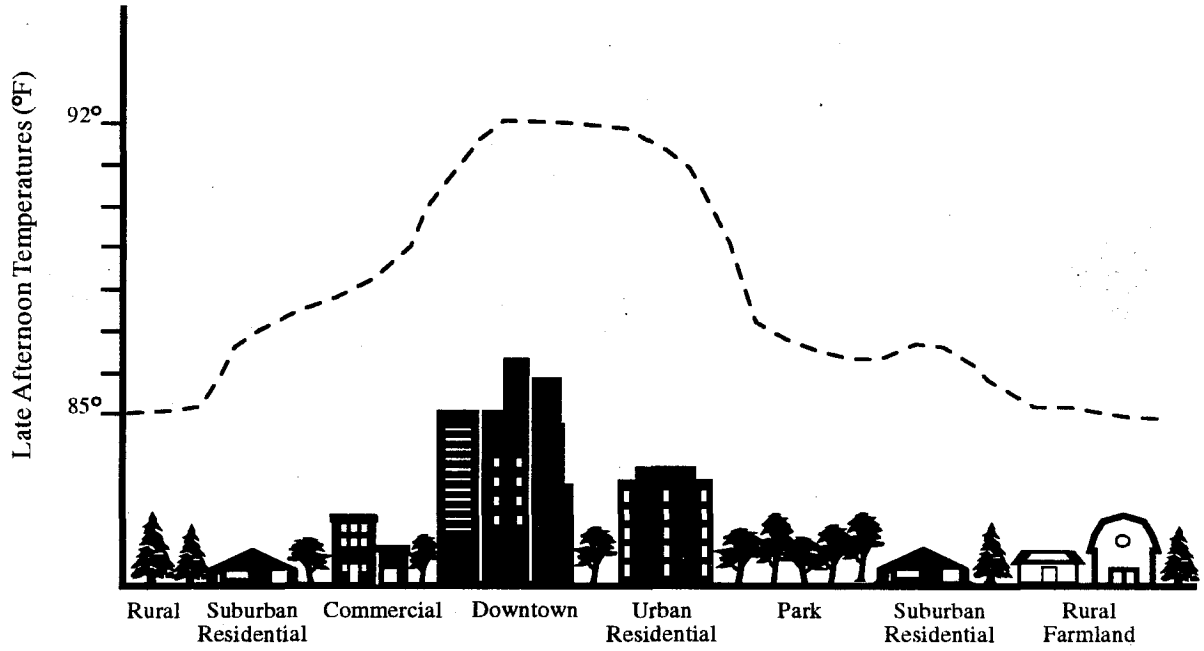
Trucking Commodity Movement

In San Luis Obispo County, trucking movements account for 8 percent of the total vehicle traffic. Commodities carried by trucks cover a wide range of goods, with construction materials accounting for 36 percent and food and farm product accounting for 32 percent of the total (San Luis Obispo Council of Governments, 1993).

Streets

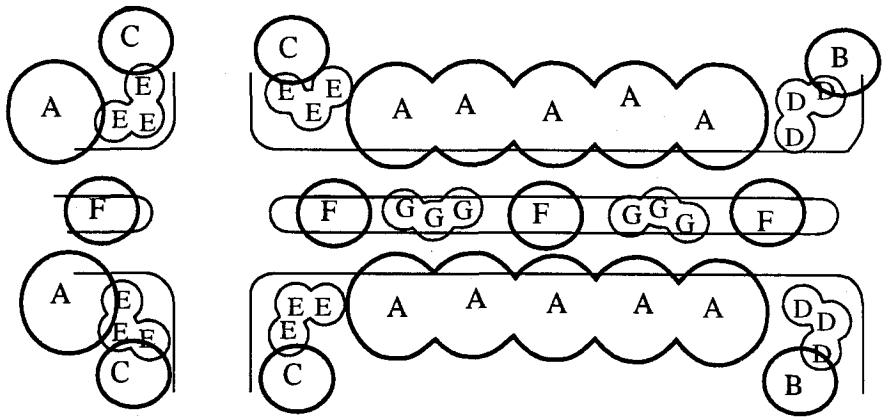
The construction of streets and the manufacturing of paving materials consume large amounts of land and energy. A more narrow road will require less grading and less paving material and will leave more land open for residential development. (If separate bicycle lanes are desired in a roadway, the parking lanes should be made more narrow or eliminated to accommodate a striped bicycle lane. This allows safe bicycle travel without increasing the road width significantly.) In hot climates, large amounts of pavement also increase the surrounding air temperature and create demand for additional energy use within nearby buildings for air conditioning (see Figure 3-6). Traffic calming measures in residential areas can decrease the speeds at which vehicles travel, reducing energy use and increasing safety. Using narrow roads and street trees can reduce the heat gain in homes from paved roads (See Figure 3-7). In Santa Barbara, old toilets are recycled into chips for energy efficient paving material (CEC, 1992). To minimize the energy used in asphalt materials, tires or old asphalt can be recycled for use in new paving materials.

Figure 3-6: Urban Heat Island Profile

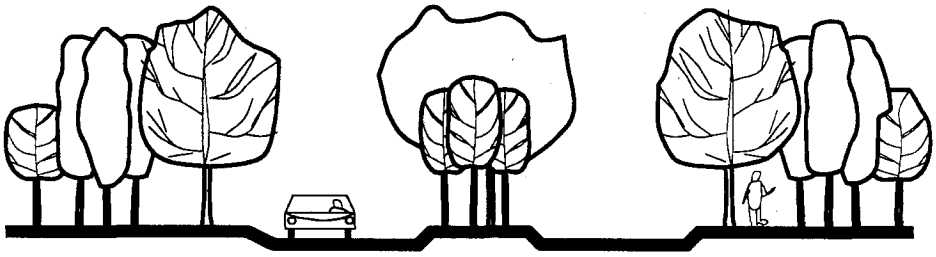


Source: CEC Energy Aware Guide, 1994

Figure 3-7: Conceptual Planting Design for Major Streets



A: Dominant tree species on both sides of the street.
B & C: Dominant tree species on side streets.
D & E: Accent species at street intersection.
F: Dominant tree species in median.
G: Accent under-story tree.



Major Street: Design continuity is dominant while still providing species diversification (7 different species).

Source CEC Energy Aware Guide, 1994

II. Goal: Increase Transportation Alternatives

Policy 7. Encourage new development to provide safe and convenient bicycle and pedestrian links among residences, transit stops, offices and commercial establishments, public buildings, educational facilities, and recreational activities.

Policy 8. Encourage bicycle and pedestrian use by supporting the policies found in the *Regional Transportation Plan*, *County Bikeways Plan* and *County Trails Plan*. This may include providing bike racks and support facilities at key locations and by encouraging the development of new bike lanes and paths.

Program 8.1. Update the *County Recreation Element* to include the *County Trails Plan* and the *County Parks and Recreation Plan.* Area plan updates should include these policies where appropriate.

Policy 9. Encourage the use of bicycles by applying for grants to purchase bicycle racks and storage facilities and then placing them in select commercial and public destinations.

Policy 10. Encourage installation of adequate and secure bike racks and storage facilities at a ratio of 1 per every 10 vehicle spaces in new commercial and public buildings with a corresponding reduction in required automobile parking spaces. Showers and changing facilities should also be encouraged.

Policy 11. Encourage and facilitate, where appropriate, the use of railways as an alternative to trucking materials out of the county by preserving existing services and rights-of-way and investigating the feasibility of increasing general freight traffic by developing additional loading facilities. Railways should also be encouraged for use by passengers.

Policy 12. Encourage the state to increase funding for transit, vehicle efficiency, and bicycle programs.

Policy 13. Encourage the development of fueling stations that distribute alternative fuels (such as methanol, ethanol, compressed natural gas, propane, electricity) to support alternative powered vehicles.

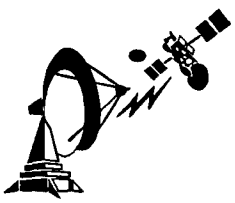
Policy 14. Offer incentives to residents and employers to purchase and use alternative fuel vehicles as funding sources become available. Funds may become available from federal government (Inter-modal Surface Transportation Efficiency Act) or from the state government (vehicle use fee or gas tax fee) in the future. One example is that employees be offered the option of receiving their cost of living increase as a bus system credit.

Policy 15. Continue ongoing efforts to convert the county fleet to clean, energy efficient, propane, hybrid natural gas/gasoline or other alternative fuel vehicles. This should occur as it is determined to be cost effective and as funding is available.

Policy 16. Coordinate with other local governments and agencies to develop a multi-modal transportation system which allows convenient and efficient use of transportation alternatives.

Telecommuting

Telecommuting allows people to minimize or eliminate the time/distance spent commuting to work. Types of telecommuting include:



- Home-based telecommuting involving employees who work at home and communicate with the main office by telephone, computer modem, and/or facsimile machine;

- Satellite business centers set up by a company to accommodate employees at a location closer to their homes than the main office. The satellite center is linked to the main office via telephones and computers, as well as video conferencing and long distance learning facilities; and

- Local/neighborhood telework centers which house telecommuters from more than one employer. Facilities can include computers, copy machines, telephones, secretarial services, meeting rooms, facsimile machines, and other equipment.

Employers that use large numbers of back-office clerical personnel would be the most likely to employ telecommuting or telework centers. Such employers could include California Polytechnic State University, Cuesta College, the County of San Luis Obispo, the City of San Luis Obispo, Atascadero State Mental Hospital, the California Men's Colony, and Pacific Gas and Electric.

The evaluation of the costs and benefits of a California State telecommuting pilot project (200 participants) found that the program paid back its initial investment within three years. Benefits were significantly greater than the costs of training, phone/modem support, maintenance, and administration. Direct benefits included decreased sick leave, turnover, parking requirements, and needed office space.

III. Goal: Use Telecommunication Technologies

Policy 17. Reduce the number of private vehicle trips by 1) encouraging the movement of information rather than cars and 2) establishing satellite offices and local telework centers.

Program 17.1. To promote trip reduction through increased telecommunications, the following steps should be considered by the county in coordination with other regional agencies:

- Evaluate the telecommunications needs of local businesses, agencies and developers to identify opportunities for using telecommunications to provide more efficient, and less costly services.

- Continue to develop through San Luis Obispo Internet an electronic *24 hour* government center which would provide users with information and services on a round-the-clock basis. The center would include an interactive phone system for accessing services.

- Encourage additional development of electronically linked work stations in residential and commercial areas.

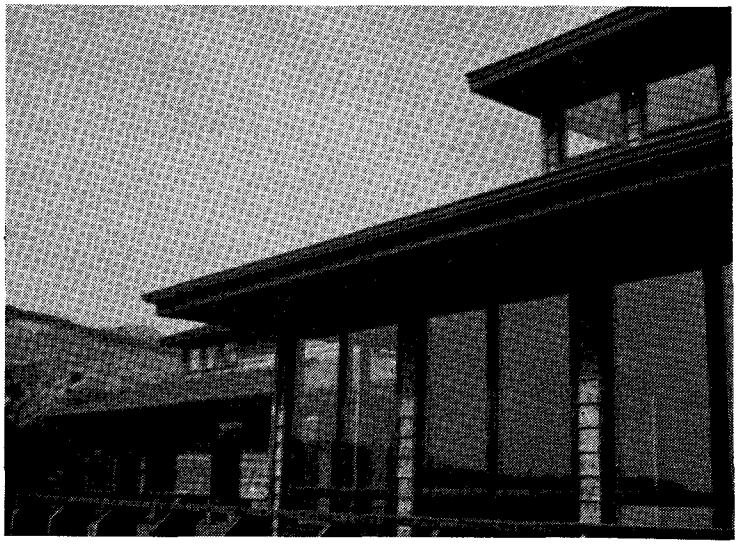
- Consider infrastructure requirements for increasing telecommunication networks in local transportation planning documents.

Buildings-New Construction and Retrofit

The next section discusses energy use in buildings and how design and retrofit measures can make a building more energy efficient. These measures can vary greatly depending on the type of building being constructed or retrofitted. Commercial design and retrofit would be different from a residential design and retrofit because of the unique use of each building. For new construction, the state and county require that all buildings comply with Title 24 of the California Code of Regulations, Energy Building Regulations, commonly referred to as Title 24. Compliance with the standards in Title 24 can be accomplished in one of two ways: 1) by selecting one of the Alternative Component Packages (the prescriptive approach) or 2) by calculating the overall energy use of the building using an approved computer analysis program (the performance approach). The prescriptive approach identifies specific measures that a building must include to comply with title 24. Compliance using the performance approach can be achieved by combining various measures in a way that ensures the building will use only a certain amount of energy as calculated by an approved computer program. Title 24 is the minimum energy efficiency standard a building must meet. Exceeding title 24 is not mandatory but it has many advantages. These include reduced utility bills, increased comfort in living areas, and decreased reliance on purchased energy sources. Retrofitting a building is often easy to do and can be very cost effective.

Buildings and Energy Use

It is relatively easy to design and retrofit buildings in the Central Coast climate to make use of passive heating and cooling and natural lighting techniques. Southern orientations, high insulation levels, some interior mass, careful placement of windows, skylights, and doors, natural ventilation, thoughtfully designed lighting, carefully selected appliances, and appropriate landscaping can all have a impact on how much or little energy a building uses. In the planning stages of building design, it is



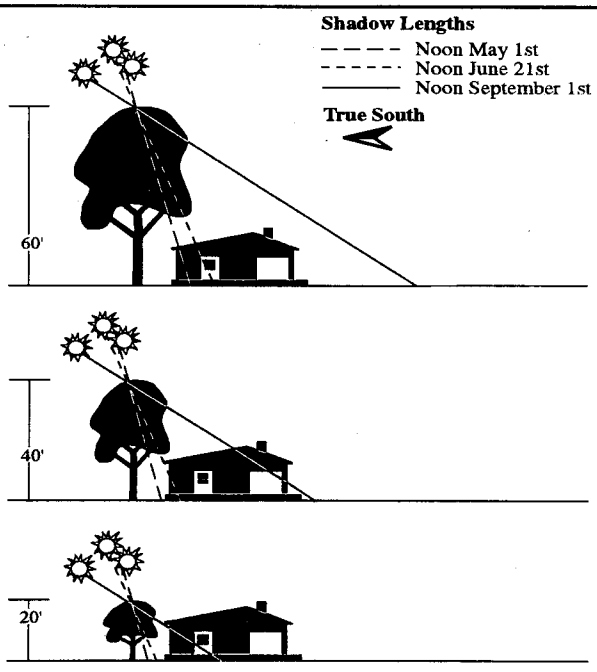
important to consider all, or a combination of many, of these features to develop an energy reduction program.

Siting and Shading

Siting a structure can have significant impacts on the energy use. Each building location can offer both opportunities and limits with regard to energy efficient site design. As noted previously, buildings which can be sited to maximize southern exposure and minimize east and west facing windows provide a simple way to achieve energy savings. Buildings should also be sited to shelter the structure from cooler north winds. If this is not possible, berms or non-deciduous trees can help to reduce wind speeds.

While the aesthetic and environmental benefits of tree planting are widely known, the valuable part that trees play in conserving energy is not as apparent. During the hottest months, trees can block sunlight from an outside wall, reducing the absorption of heat, and thereby reducing cooling costs (PG&E, 1993). The east and west-facing walls of a house receive maximum exposure to the sun during the summer, and should be shaded (see Figure 8). In very hot areas, planting trees along the southern walls may also be appropriate. Canopy trees are generally preferable for shading, and the best canopy trees will have a round or spreading form. For most homes, trees that reach 25 feet to 45 feet in height are ideal. The trees should also be deciduous with an open branching structure that allows winter sun to warm the house.

Figure 3-8: Tree Heights and Shading



Source: San Luis Solar Group, 1994

Note: Sun angle for 36° N Latitude

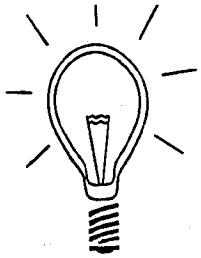
Insulation

Insulation is an inexpensive and very effective method of energy conservation. Well-insulated walls, attics, and floors can reduce heating and cooling costs significantly. In existing buildings, it is often easiest, and most cost effective to add attic insulation.

It is also possible to add wall insulation to older homes. Foam insulation can be blown into spaces between framing members through small holes drilled in the exterior. This avoids extensive removal of siding materials, but it does create numerous small patch marks in exterior walls that must be repainted.

In new homes, high mass materials (such as concrete, brick, or stone) should be encouraged in south facing rooms where the winter sun strikes the interior. These materials absorb heat during the day and then radiate heat into the home at night. These high mass materials can be used effectively in other rooms as well. The roof, floors, and walls should all be well insulated.

Lighting



Lighting can be a large part of the energy use in a building, especially for commercial and industrial uses. Yet, many businesses have very inefficient lighting designs. In existing buildings there are several methods of improving lighting efficiency: incandescent fixtures can be converted to fluorescent; compact fluorescent bulbs can replace incandescent bulbs in standard light fixtures; optical reflectors can be installed to double the amount of light emitted from a single fluorescent bulb, and fluorescent current limiters can also be used to reduce the power needed for each lamp, reduce the amount of heat produced by the lamp, and extend the life of the lamp.

In general, most buildings have more lighting fixtures than are necessary for comfortable lighting levels (PG&E's Pacific Energy Center). Daylight from windows and skylights should be used as the primary lighting source. Enclosed sun rooms or patios can also be used to provide light to interior rooms. Overall lighting levels can be reduced, and then task lighting can be used where and when necessary. Task lighting directs light to necessary areas without wastefully lighting a larger area. Outdoors, halogen lighting or high pressure sodium lamps should be used instead of incandescent or mercury vapor lamps.

Windows and Doors

Windows and doors play a key role in energy efficiency. In existing buildings, one of the most effective and least costly energy saving measures is to repair broken windows, properly caulk all windows, and weatherstrip all doors. Single-paned windows should be replaced with double-paned windows whenever possible. The installation of storm windows is a lower cost alternative that can also minimize the heat lost through windows during the winter months. Drapes or blinds that are specifically designed to insulate window surfaces also decrease energy use.

Window placement should be an important design consideration in new buildings. If possible, windows should be facing in a southerly direction to maximize the solar heat gain through the windows in winter and allow easy shading in the summer. Likewise, only a few windows should face east or west to minimize the solar heat gain in summer. If the building site necessitates east and west facing windows, selecting a proper window glazing can minimize heat gain. Awnings or louvers can minimize direct summer sun while still allowing winter sun into the building. It is also very important that windows be operable, i.e., they can be open and closed. This allows easy opportunities for ventilation and heating directly from the outside.

Timing Devices

Simple timing devices save energy by only providing the energy-consuming feature during the time of use or occupancy. For example, motion detectors can be used to turn on lights when they detect a person in a room or area, which is particularly useful in rest rooms, storage areas, garages, etc. Programmable thermostats that automatically regulate a consistent temperature for air conditioning and heating can also save money. Outdoors, a photocell can be used to automatically control an exterior lighting system. The photocell monitors the natural sunlight and turns lights on as the sun goes down and off as the sun rises.

Appliances

Appliances (such as heaters, air conditioners, and refrigerators) make up a large part of energy use in residential, industrial, and commercial buildings.

Cooling Appliances. Air conditioners tend to be very energy inefficient. However, there are several other options to consider for cooling a building or space. Installing ceiling fans or attic fans can eliminate the need for air conditioners in milder climates. A second option is to install an evaporative cooler or condenser pre-cooler. If an air conditioner is needed, the most efficient model available should be used. Older units are much less efficient than some of the newer models and should be replaced when feasible.

Refrigeration appliances. In residential buildings, replacing an old refrigerator can dramatically cut electricity costs. Almost all new refrigerators have about the same efficiency, although smaller models use much less energy than larger models. In commercial buildings, horizontal, open-air refrigeration units are the least efficient. If it is infeasible or undesirable to replace these units, clear acrylic strip curtains can be hung over the refrigerated items to keep some of the warm air out. If the open-air unit is vertical, glass or acrylic doors should be installed to reduce energy use. Wherever and whenever possible, high efficiency upright refrigeration cases with glass doors should be installed.

Cooking appliances. Open-flame burner plates or fryers and griddles are inefficient and should be replaced by ceramic infrared burners. Older stoves and ovens should be replaced with more efficient models. Microwave ovens which use less energy than electric or gas ovens, should be used whenever possible.

Others. Gas appliances should be used in place of electric or propane units wherever possible, particularly stoves, ovens, and water heaters. Significant improvements have been made in motor efficiency, and old motors should be replaced with high efficiency models.

Water Fixtures

Water use is also an important part of energy conservation and energy efficiency in buildings. Aside from conserving a locally limited resource, efficient use of water means less energy used in heating, pumping, or transporting water and less energy to treat the wastewater.

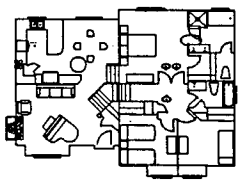
In existing buildings, repairing leaks is the most cost effective method to save water. It is also important to develop the habit of turning off all faucets, sinks, and hoses when not in use. Existing buildings should install new ultra-low flow fixtures (such as shower heads and toilets). Faucet aerators decrease flow and are an inexpensive water conservation method.

Another option is to install solar panels to pre-heat (warm) water before it enters the water heater. This reduces the amount of energy used by the water heater.

For outdoor landscaping, water efficient sprinkler and/or drip irrigation systems which include timers set for the early morning or late evening watering should be installed in conjunction with low water use or drought tolerant plants.

Swimming pools use a lot of energy for water filtering and pumping, and even more if they are heated. Integrated cleaning and heating systems (including pool covers and efficient filters, pumps, and motors) will also save energy and can be cost effective for residential pools. Solar pool heating is a viable alternative to gas and/or electric systems and can significantly reduce energy costs. Regardless of the initial heating system selected, separate inlet and outlet pipes should be installed to allow for a solar heating system. Installing the fixtures will cost very little at the time of pool construction but can be a very costly retrofit.

Other General Design Features



Some additional design considerations for an energy efficient structure include an open floor plan, use of courtyards, breezeways, and atriums. An open floor plan (one with few walls) allows internal circulation of air. This creates a more uniform air temperature in the building and enables cooling and heating appliances to be more effective. Breeze-ways create a cross-current of air and can be used to bring cool air into the interior of the building, thus reducing reliance on cooling appliances. In larger buildings, atriums can be designed to act as natural cooling mechanisms and to increase interior lighting. If designed correctly, atriums not only provide a feeling of spaciousness within buildings, but they can also assist in providing light to interior offices and reduce the need of air conditioners.

Energy Saving Measures for Residences

Often, residential consumers will not invest in energy saving measures because of the initial cost. For example, a person may not replace an older refrigerator to save money but ends up paying higher energy bills over the life of appliance. Even simple programs, like supplying apartments and duplexes with separate utility meters, make residents aware of their energy use and encourage conservation.

There are several energy efficiency programs available to residential builders, owners and tenants, including low income household weatherization, home improvement and retrofit loans, and utility-sponsored incentive programs.

- The Economic Opportunity Commission in San Luis Obispo coordinates the implementation of free weatherization programs for low income residents throughout the county.

- Energy efficient mortgages (underwritten by the federal government) can be used to finance energy improvements. The idea behind these financing tools is to account for the energy cost of a home when determining a buyer's ability to repay the mortgage. A home with a lower utility bill will make it easier for the owner to repay the mortgage (CEC, 1992).

- PG&E offers rebates on energy efficient appliances (refrigerators, air conditioners, heaters, etc.) and special rates to residences that curtail electricity use during peak energy hours (weekdays between noon and 6:00 p.m.).

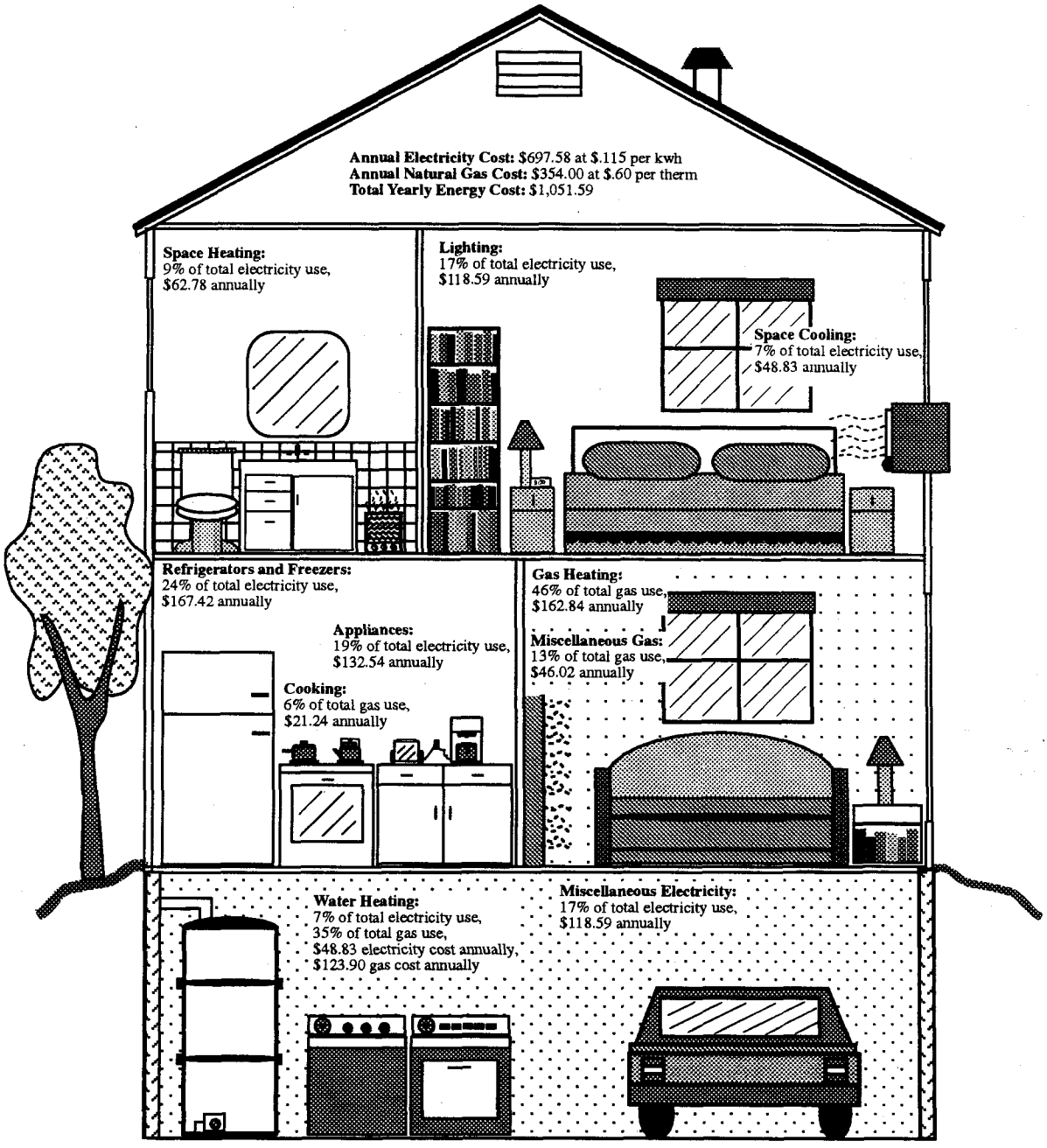
- PG&E also offers two programs for single-family homes, including the *California Comfort Homes*, and *Showcase Homes*. Both new construction programs offer cash incentives to builders or individuals who build homes which are heated and cooled more efficiently than required by the California Building Energy Efficiency Standards.

- Southern California Gas also has a program (*Five Star* homes) that recognizes energy efficient homes. The home builder is eligible for rebates on energy efficient space heating and water heating systems and wall insulation. The program also awards a plaque, consumer literature promoting the award, and camera-ready art work that the builder can use in advertising promotions.

Figure 3-9 shows the percentage and cost breakdown of energy uses within the home. This information is based on the average California household and adjusted to reflect past energy use in San Luis Obispo County. (Tables showing information on both household and commercial energy consumption can be found in Appendix C.)

Given the relatively mild climate in San Luis Obispo County, a well-designed residence could significantly reduce the energy needed for space heating and cooling and water heating. This could save the owner almost $500 a year in energy costs. Additional programs (such as day-

Figure 3-9: Average Household Energy Consumption



Source: Percentages taken from the California Energy Commission, Energy Efficiency Report, 1990, Table A-4. Household energy is based on total energy sales in San Luis Obispo County for 1990.

lighting which uses the sun as a lighting sources rather than artificial light) would reduce utility bills even further.

Depending on how much money a homeowner is willing to invest in energy efficiency, a retrofit on a home can save anywhere from 10 to 75 percent of the monthly energy bill (Nava, 1991). Given an estimated average bill of over $1,000 per year, the savings could be between $100 and $750. Even if a household achieves an average of 20 percent savings, the total energy bill would decrease by over $200.

Heating/cooling demand can be reduced by an average of 20 percent by adding attic insulation. Fluorescent lighting uses one-third the amount of electricity when compared to standard bulbs (equivalent to a 67 percent reduction in lighting). Adding an insulation blanket to an electric water heater can save 5 to 15 percent of the energy use; on gas water heaters, the savings range from 7 to 12 percent.

Using conservative estimates, adding insulation, hot water blankets, and fluorescent lighting can save over $131 each year for each home. The initial costs for these measures would be around $500, assuming a modest, single story, home with no roof insulation. If 10 homes implement the above measures, the total savings would be over $1,300.

Table 3-3: Where can energy be saved?

Energy use	Percent of Actual Use	Average Annual Cost	Potential Savings	Total Savings
Heating-cooling	30%	$315	10%	$33
Water heating	26%	$273	5%	$14
Refrigeration	11%	$116	10%	$12
Cooking	5%	$52	5%	$3
Clothes drying	4%	$42	5%	$2
Motors	4%	$42	5%	$2
Color TV	2%	$21	5%	$1
Lighting	9%	$95	10%	$10
Other uses	9%	$95	5%	$5
Total	100%	$1,051	8%	$82

Source: Conservation and Efficiency Working Paper, CMS, on file with Department of Planning and Building.

Energy Saving Measures for Commercial and Industrial Buildings

By saving energy through the more efficient construction and operation of commercial and industrial facilities, businesses profits will increase. The potential for savings is great because such facilities may use large amounts of energy for manufacturing processes, space heating or cooling, refrigeration, and lighting.

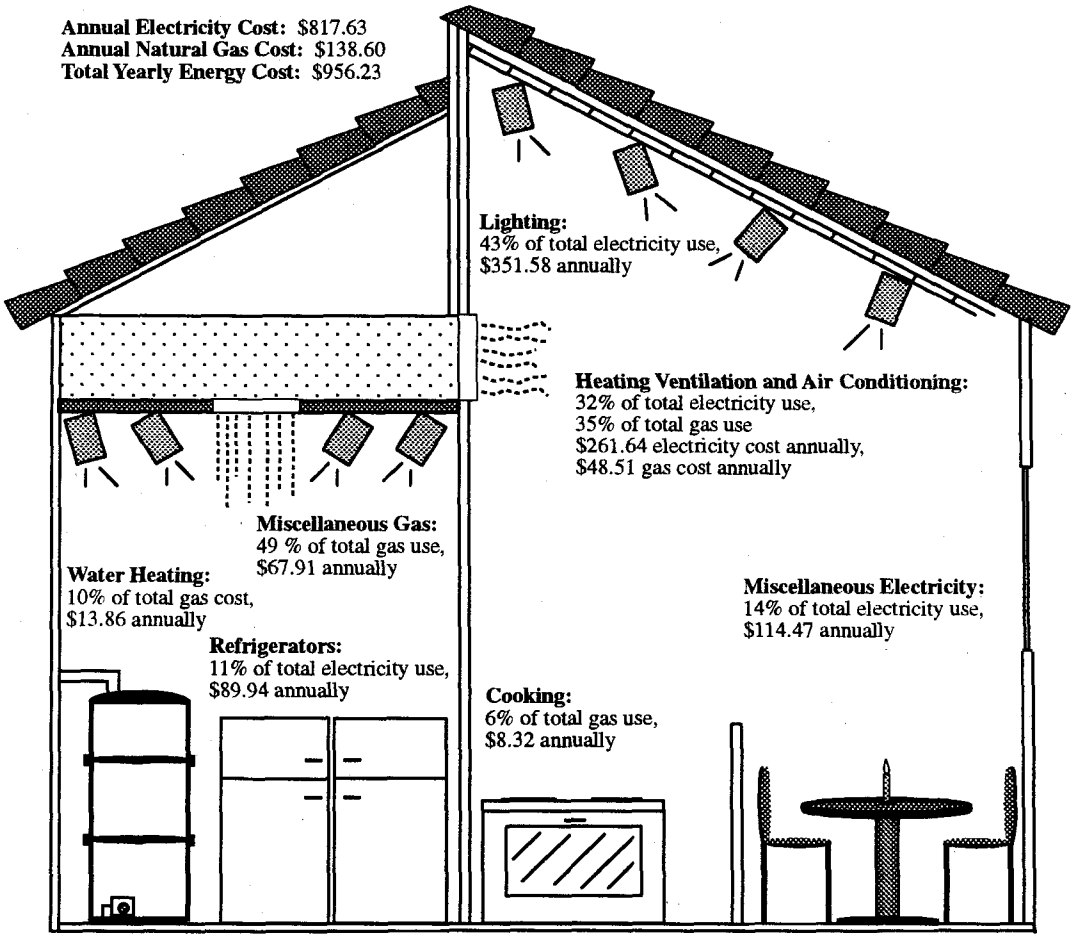
Commercial and industrial retrofits can be generally more effective than residential retrofits. This is because many of the large energy uses (i.e., lighting and appliances) are geared toward tenant improvements and can be replaced fairly easily.

PG&E offers cash incentive programs to commercial, industrial, and agricultural businesses that retrofit for energy efficiency. Retrofit programs provide cash rebates for specific energy efficient equipment or appliances. Contact PG&E for more information about retrofit programs that might be available.

Southern California Gas offers a number of incentive programs to users that replace equipment, such as space heaters, water heaters, cooking appliances, dryers, boilers, gas engines, and air conditioners. Incentives are also provided for retrofit programs such as wrapping pipes, insulating water heater tanks, installing water flow restrictors, and insulating ceilings (Southern California Gas, 1993). Southern California Gas also offers rebates to industries that install a heat recovery system to recapture and reuse heat lost during manufacturing and processing.

The business in the following figure is based on information compiled by the California Energy Commission from data on all commercial energy use in California and on past energy sales in San Luis Obispo County for 1990. The information is very general, but because commercial energy use does vary significantly, it should serve as a reasonable estimate for comparison.

Figure 3-10: Average Commercial Energy Consumption



Note: This assumes a rate of 12 cents per kwh for electricity.
Source: California Energy Commission, 1990.

Again, a well-designed building could reduce all heating/cooling costs and significantly reduce lighting costs. For example, by using extra insulation and an efficient HVAC system as much as 20 percent to 50 percent could be saved. Also, day-lighting a room could save 15 percent or more. Additional programs (such as installing very efficient refrigeration units) could be included to further reduce utility bills.

Although savings will vary according to the physical design and the nature of the business, energy efficiency priorities in retrofitting are generally the following: 1) improve inefficient lighting by replacing incandescent bulbs with fluorescent fixtures, using metal halide or high pressure sodium lights outdoors, and installing motion or light sensors and timers; 2) decrease the cooling load by adding insulation, weatherstripping doors and windows, and improving the efficiency of cooling devices; and 3) replacing inefficient models of major appliances such as heaters, refrigerators, and freezers.

Lighting. Commercial users can reduce lighting energy use by designing a lighting system that replaces incandescent light bulbs with compact fluorescent fixtures[3] and/or installs fluorescent lamps with optical reflectors.

HVAC. Heating, ventilation, and air conditioning (HVAC) are also big energy users. Replacing inefficient air conditioners with evaporative coolers can reduce energy use by 80 to 90 percent. Condenser pre-coolers reduce air conditioner energy use by blowing the air over water to cool it before it is introduced into the air conditioning system's condenser.

Cooking. For cooking needs, infrared fryers have an efficiency rating of around 80 percent. A conventional fryer only operates at around 47 percent efficiency. Replacing deep fryer units with infrared would give an approximated 33 percent savings.

Refrigeration. Two options exist for refrigeration needs. Strips of clear acrylic plastic (strip curtains) can be used in upright refrigerators and cold storage areas (such as fruit and vegetable displays) help keep refrigeration costs down. The curtains are especially good in high traffic areas, because they do not require opening or closing. The strips are inexpensive and easy to install. Glass and acrylic doors are more efficient than strip curtains, saving up to 50 percent on energy use.

Using conservative estimates, a business could save as much as $220 dollars a year by installing fluorescent bulbs, adding attic insulation, and installing strip curtains to refrigeration units. The cost of making these retrofits would be around $640. If five commercial buildings implemented such measures in the first year, a total of $1,100 would be saved in energy.

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[3] In addition to cost savings, PG&E offers rebates on many lighting fixtures and major appliances. These rebates are not always guaranteed and are subject to change, but should be investigated at the time of retrofits.

IV. Goal: Design Energy Efficient Projects

Policy 18. Discretionary projects should include in their project description measures proposed to maximize energy conservation and a discussion of the potential energy impacts of the project.

Guideline 18.1. New construction should be designed for solar access, including passive solar insolation, where practical. Benefits include decreased heating and cooling costs, reduction in lighting needs, and overall reduction in energy use.

Guideline 18.2. In multi-family residential projects, where the potential for solar benefits in an individual unit may be limited to one or two directions, the following guidelines should be employed by the developer/designer to make the best use of solar potential.

- Units with south, southwest, or southeast exposures should be designed for maximum passive solar heating except for units with poor solar access.
- Units with north, northwest, or northeast exposures should use double paned glass for all exterior envelope glazing area to compensate for lack of solar heat gain.
- *Through units* [4] with a southern exposure facing a street should locate the main living area on the south side of the building and be designed for maximum passive solar benefit, except for units with poor solar access.
- Through units should be encouraged over single aspect units to improve natural ventilation and reduce cooling costs.
- Pitched roofs that are oriented to the south should used when possible to access the sun for solar installations.

Program 18.1 Develop information sheets about energy guidelines and make them available to applicants in the process of obtaining development and land use permits. The sheets should reference the applicable portions of the Energy Element.

Program 18.2. Develop a voluntary rating system which considers how the built environment has an impact on natural resources and the quality of the environment The developer would document whether proposed units exceed Title 24 requirements as the units receive building permits. One objective of this program is to encourage new housing units to exceed Title 24 requirements and employ other resource conservation measures. It will be a voluntary rating system used by developers in the area that want

[4] Through units are those that have two exposures at opposite compass points. For example, a north/south or a southeast/northwest exposure.

to emphasize environmentally sensitive construction as part of a marketing/selling approach. Six issues which could be included are:

- energy efficiency and conservation;
- building materials;
- solid waste systems;
- on site energy systems;
- environmental sensitivity; and
- non-traditional building materials.

Program 18.3. Amend applicable ordinances to provide incentives such as providing for a density bonus and priority in the county's growth management system, for development projects that achieve a high ranking in the program described in Program 18.2.

Program 18.4. Modify applicable ordinances to require that all new multi-family residences and secondary residences have individual meters for gas, electricity, and water. The meters should be grouped together for ease of auditing. The objective is to have individual utility meters on all new multi-family residences and mobile homes consistent with California Public Utilities Commission's Regulations.

Program 18.5. Develop a program which considers energy efficiency improvements in conjunction with any major additions to a home. The improvements should include such items as R-30 insulation in homes with accessible attics, weatherstripping around doors and windows, insulated hot water heaters, and energy efficient lighting in kitchens and bathrooms. Major additions include all projects that will involve more than 20 percent of the existing floor area of the house. The objective of this program is to increase energy efficiency of existing homes. Equivalent alternatives such as replacing existing inefficient heating systems or windows should also be encouraged.

Program 18.6. Amend applicable ordinances, consistent with Appendix F in CEQA, to require that all CEQA documents evaluate potential energy impacts of a project. Particular emphasis should be focussed on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy.

Program 18.7. Amend or create applicable ordinances to protect solar access in accordance with the Solar Rights Act and Solar Shade Acts of 1978. Ordinance amendments would address obstructions to sunlight from reaching south facing areas or solar collectors.

Program 18.8. Support special demonstration projects that incorporate a variety of energy efficient and sustainable attributes through design or alternative building materials. These projects should be given priority processing and a reduction of fees where appropriate.

Policy 19. Design new residential units to provide for the most effective use of solar radiation for heating and ventilation at night for cooling by requiring the following information: site plans and elevations that show winter orientation and summer sun control for windows and doors and the orientation and proposed screening of solar collectors, if any.

> **Guideline 19.1.** Roof mounted collectors should be installed with consideration of aesthetic concerns. Issues that should be addressed include overall visibility, screening of storage tank, mounting racks, and collector panels, and the color and angle of collector panels. Nothing in this guideline shall be construed to prohibit the owner of a legal solar collector unit from raising or lowering panels to take full advantage of the sun.

Policy 20. Preserve and care for existing trees along and in public streets and parking lots. Select appropriate species of street and parking lot trees in new development that optimize winter solar access and summer shading as much as possible.

> **Program 20.1.** Develop a tree planting program that seeks to coordinate community resources to plant trees. The program should be funded through grants or other sources. If the program is feasible and popular, it may be more effective to concentrate work in selected areas. This would save on time and energy needed to move equipment and trees. The objective of this program is to plant at least 1,000 trees each year. The City of San Luis Obispo's is a good example of this type of program.

Public Facilities

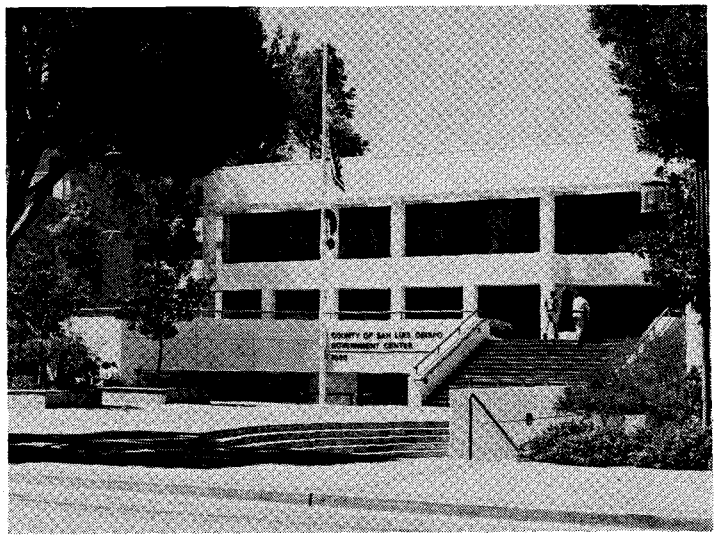
The county has the opportunity to set an example regarding the application of energy efficient practices. This section examines public sector energy use, including building energy use, county vehicle fleet operations, wastewater treatment, and water use. Government agencies tend to have long-term occupancy, creating a more positive opportunity for long-term energy investment returns.

Government operations consume a large amount of energy. Vehicle fleet operations are the major users, followed by water pumping and wastewater treatment. Buildings are the third major use class. In 1991, government building operations in San Luis Obispo used 134,472,000 kWh of electricity and 9,415,000 therms of natural gas. This is 13 percent and 14 percent of total electricity and gas use respectively.

New County Building Program

Energy efficiency should be a priority in the design and purchase of all new public facilities and equipment. In particular, county facilities should exemplify energy efficiency to give local residents a model of new energy efficient facilities and equipment. A new building could be

used as an energy museum or model, with windows or view spaces into functional design features. Funding for such public facility projects is available through the California Energy Commission. The *Energy Partnership Program* provides funding of public facility audits and energy efficiency improvements.



County Building Retrofit Program

Energy audits have been performed for several county-owned facilities. It is the current county policy to replace energy related items with more efficient technology. The county has received $130,000 in rebates from local utilities for retrofits already completed. Currently there are also low interest loans available from the California Energy Commission for energy efficiency projects. The CEC can assist with the administrative work, including contractor selection.

County Vehicle Fleet

Reducing fuel consumption in the county vehicle fleet will result in less air pollution and direct economic savings through decreased fuel purchases. One of the best methods for increasing efficiency is to schedule regular maintenance for the fleet vehicles. Regular maintenance, including minor tune-up adjustments, can improve fuel economy an average of 1 to 5 percent (CEC, 1992). Through the Energy Partnership Program, the CEC can train county personnel in methods to reduce vehicle fleet fuel use.

The county should continue to investigate converting the fleet vehicles to use alternative fuels such as propane, methanol, ethanol, natural gas, or electricity. Because of the centralized fueling stations, many government fleets are attractive candidates for use of alternative fuels.

Wastewater Treatment

There are several wastewater treatment facilities in San Luis Obispo County, including; Avila Beach, Cambria, Los Ranchos, Morro Bay/Cayucos, Nipomo, Paso Robles/Templeton, Templeton-Meadowbrook, San Miguel, San Simeon, and South San Luis Obispo County. However, the county does not have direct control over the operation of these facilities, which are run by special districts and funded by the residents served.

Other Governmental Agencies

There are a number of large, state and federal institutions in San Luis Obispo County: California Polytechnic State University, Cuesta College, the California Men's Colony, and Atascadero State

Mental Hospital. These institutions present excellent opportunities for telecommuting; energy conservation and energy efficiency programs; and biomass and/or cogeneration facilities.

Potential Savings

Because this discussion is centered on a few specific buildings, generalizations and averages may not apply to San Luis Obispo County; nevertheless, 25 percent of energy use in an average community services building is for air conditioning, 45 percent for lighting, 15 percent for motors and ventilation, 5 percent for refrigeration, and the remaining 10 percent is for miscellaneous uses (PG&E, 1992). Because lighting is the largest portion of the total energy use, replacing incandescent bulbs with compact fluorescent lamps will affect total use. In general, replacing inefficient equipment will have a significant affect on total use.

The energy savings in new construction projects would depend on the size of the new public building or the extent of the renovations and the specific energy needs. A smaller building will probably work more efficiently, but the potential savings on a large building would be much larger. The existing county buildings will probably continue to accommodate most of the county's employees. New buildings will most likely house new or expanding departments.

Hiring an architect experienced in solar systems to design an energy efficient building could possibly require additional architectural fees compared to a standard building. If so, the additional design and construction costs will be offset by the energy savings over the life of the building. Although the specific energy savings cannot be calculated until a project is proposed, it is expected that energy costs will be half of what would occur in standard architectural designs.

V. Goal: Improve Energy Efficiency in County Operations

Policy 21. Continue cost effective efforts to become a model energy user in the provision of services and the maintenance of county facilities and equipment. The purposes are to 1) demonstrate to county residents and businesses the benefits of energy efficiency and conservation, 2) reduce costs of government, 3) reduce dependence on imported energy, and 4) improve air quality.

Program 21.1. Develop an educational incentive program that encourages efficiency and conservation by employees in county departments.

Program 21.2. Continue to audit county facilities and identify the energy and water conservation retrofits that will be cost effective. The audit should consider the following:

- Appropriate lighting levels and ways of employing motion and light sensors, energy saving ballasts, replacement motors and metal halide or high pressure sodium outdoor fixtures.

- Appropriate air conditioning and heating levels and the necessary improvements to county buildings and equipment.

- Landscape maintenance and appropriate water conservation programs, such as toilet replacement, water efficient landscaping, and water use/reuse.

- Converting 50 percent of the vehicles in the county fleet to reduced-emission vehicles.

- Continuing to monitor the employee bicycle pool for effectiveness, future demand, and needed improvements.

Policy 22. Incorporate cost effective energy efficient design into all new county buildings. Continue to audit county facilities periodically to identify potential energy efficiency improvements. Incorporate applicable modifications into future capital improvement plans and the annual budget.

Agriculture

Like other energy users, agriculture faces the challenge of enhancing productivity while sustaining its resource base and protecting the environment. In San Luis Obispo County, agriculture is a key component of the economy and the environ-ment. Because energy costs affect profits so directly, agriculturists are often highly aware of the energy costs associated with their operations in general and with individual pieces of machinery (e.g. well pumps) in particular. Farmers, ranchers, vintners, etc. often implement energy efficiency measures whenever possible. Almost all farmers and ranchers receive regular energy audits from PG&E. Often they will plan pump inspections on a yearly basis.

Energy Saving Measures and Options

There are numerous methods of conserving energy that many farmers and ranchers have practiced for years. Depending on the type of farm or agricultural use, there are different methods of conservation. These include: minimizing fertilizer applications, minimizing cultivation, and other soil conservation techniques. Other techniques include using correct machinery for the task, conserving water, using drip irrigation, minimizing truck trips to check

and feed cattle, insulating hot water lines in dairies, maintaining water pumps on a regular basis, installing energy efficient appliances, and insulating greenhouses. The major difficulty in implementing agricultural energy conservation methods is recognizing and optimizing tradeoffs. While mowing rather than cultivating a field may reduce energy initially, more energy may be required later if a weed species emerges that requires extensive energy use for its eradication.

Potential Savings

The *Environmental Setting Report* for the *Energy Element* identified 1,110,600 acres of non-irrigated and 56,700 acres of irrigated farmland in San Luis Obispo County. From the energy use section of this report, we know that 69,085,000 kWh were used by the agriculture sector in 1991. Assuming that improved methods of pumping water are able to increase efficiency 5 percent, a total of 3,454,250 kWh could be saved. Agricultural rates range between 6.5¢ to 13¢ a kWh (PG&E, 1993), making the yearly savings $225,000 to $449,000.

VI. Goal: Encourage Agriculturalists to Save Energy

Policy 23. Encourage agricultural advisory groups to continue to develop and share information regarding state of the art energy conservation and efficiency measures available to agriculturists.

Policy 24. Encourage the development of local biomass and composting facilities in locations where land use conflicts can be minimized.

Energy Education

The Value of Energy Education

Energy conservation and efficiency measures sometimes do not work simply because people either do not know about them or are not aware of their potential to save energy. The best way to save energy is through changing behaviors that lead to waste. We have become so conditioned to using what we want, when we want, that using less or using something more efficiently is not part of our daily lives. Typically, it takes a crisis for us to change wasteful behaviors. Europe and Japan use energy twice as efficiently as the United States. Education is a key tool in changing our behaviors and values.

Potential Savings

A study on the effectiveness of educational programs in conserving energy showed that information campaigns produce an average of 4 percent energy savings. An audit of energy use or other direct feedback on consumption can create an 11 percent savings, while financial incentives can

generate 15 percent savings. Combinations of these strategies average around 15 percent but can go as high as 29 percent (CEC, 1988). The following identifies some education based measures;

- Close off unused living areas;
- Keep heating and cooling vents clear of obstructions;
- Heat only to 68^0-cool only to 78^0F;
- Flush buildings with cool air at night;
- Clean and replace heating and cooling filters;
- Reduce hot water temperature levels;
- Arrange rooms to take advantage of natural light;
- Turn off lights that are not being used; and
- Combine vehicle trips to decrease gasoline consumption.

Within San Luis Obispo County the savings may be small, but the overall savings can make a difference in the nation's energy use. The total 1990 residential kilowatt-hours used in the county was 487,018,000. A 4 percent saving at 12¢ per kWh gives a saving of $2,340,000 or $11.23 per capita per year. This is based on a 1990 population of 208,129.

VII. Goal: Increase Energy Awareness

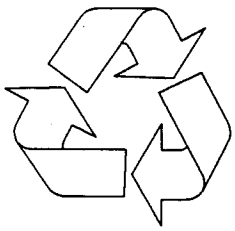
Policy 25. Work with local utilities to maximize the use of conservation and efficiency programs. Continue to develop broader education and incentive strategies which will encourage homeowners, landlords, and tenants to install energy and water efficient fixtures and equipment.

Program 25.1. In cooperation with local utilities, establish an energy information center in the public area at the Department of Planning and Building. The center would provide brochures and materials about rebate and efficiency programs that reduce the costs of installing energy saving measures.

Program 25.2. Develop an information sheet on energy and water efficient design guidelines and make it available to applicants obtaining building and land use permits. The information sheet shall include information on the benefits of energy efficient design and provide phone numbers and addresses of agencies or people that can provide more detailed information.

Policy 26. Seek grants to sponsor energy education programs to increase public awareness about energy conservation, energy efficiency, and recycling opportunities and to inform people of the potential benefits of such programs.

Recycling and Reuse



Californians produced an estimated 44 million tons of solid waste in 1990. Because the amount of waste generated per person is steadily rising, the size of California's waste stream will continue to grow as the population increases. With a projected state population of 36.3 million residents by the year 2000, California will generate 60 million tons of garbage each and every year.

In 1989 and 1990, the Governor and Legislature recognized the need to change how waste is managed in California by adopting *integrated waste management* legislation (AB 939). The law gives renewed emphases to conservation of natural resources by reducing, reusing, and recycling waste. Cities and counties must reduce the amount of waste going into landfills: 25 percent by 1995 and 50 percent by the year 2000 (California Integrated Waste Management Board, 1992). The county is currently working on a *Source Reduction Recycling and Household Hazardous Materials Element* and anticipates adoption by the county in July, 1994.

The time it takes for the county's landfills to reach capacity depends on several factors: 1) the success of recycling and reuse programs in diverting waste from landfills; 2) the rate of population increase; and 3) the growth rate of the county. The status of each landfill is as follows:

Cold Canyon Landfill	**Recently expanded**	**10-15 year lifespan**
Chicago Grade Landfill	**Not yet expanded**	**9-12 year lifespan**
Paso Robles Landfill	**Recently expanded**	**25-50 year lifespan**

Energy Saving Measures and Options

Energy is used to manufacture the products that eventually become waste. Energy is also used to collect and transport that waste. Recovery of recyclable material from municipal solid waste can both save energy and extend the life of county landfills. There are three important components to a recycling program: reduce, reuse, and recycle. To complete the loop, the county should also look at purchasing recycled materials and encouraging recycling businesses.

Reduce. Reducing the amount of waste generated by not producing it in the first place is the best way to eliminate solid waste and save energy. Products can be sold with less packaging and manufacturing processes can be changed to avoid waste. The county should purchase products in bulk quantities and minimal packaging.

Reuse. Reusing products and materials in their original form can save more energy than recycling because energy is not used to transform the materials into new products. Examples of materials that can be reused in homes, businesses, or local government include appliances, furniture, bags, boxes, other containers, building materials, scratch paper, clothing, wood pallets, reusable cups, glasses, refillable beverage containers, refillable toner cartridges for printers, cloth napkins and linen service.

Garage sales are a method to encourage reuse. Yard wastes make up about 20 percent of the residential waste stream in California. By composting this material, residents can reuse the product as fertilizer.

Recycle. Recycling paper, metals, and glass can save significant quantities of energy. Raw material must be extracted and refined before being used; the use of secondary materials eliminates the energy consumed in extraction and refining. Collecting recyclable material before it goes to the dump or separating and recycling material prior to final disposal at county facilities are two options of material recovery. Voluntary participation is generally high if people are made aware of the program operation and benefits. However, demand and prices for recycled materials are volatile, depending on the price and availability of virgin material. A recycling program needs to establish long-term contracts with buyers so that changes in demand do not leave the county with large quantities of material to store or dispose.

Buying Recycled Goods. Buying recycled goods sets a good example for other county businesses and other cities. It also helps establish and enhance the market for recycled products by increasing the demand for them. The city of Carlsbad has established a policy to buy recycled goods whenever possible, even if the cost is slightly higher. The city council policy allows for a 15 percent preference not to exceed $1,000 per contract for the purchase of recycled products.

Recycling Businesses. At the same time that we conserve resources, reduce litter, and divert waste from overburdened landfills, we also can establish recycling as a permanent tool for creating jobs and sustaining our economy over the long-term (California Department of Conservation, 1993). Recycling cuts across diverse sectors of the economy, involving services, processing, manufacturing, and distribution for a wide range of products and materials. A study from the California Integrated Waste Management Board estimates that diverting 50 percent of the state's waste stream from landfills (as mandated by AB 939) could lead to 40,000 or more new jobs in California by the year 2000. These jobs would be in the processing of recyclables and in the manufacture of recycled-content products.

Potential Savings

Reusing products saves the energy costs associated with that product. Recycling efficiencies can vary, but can be quite high. Recycling copper and aluminum reduces energy requirements for

the production of new materials by over 90 percent. Energy reductions of over 70 percent can be achieved in steel and low grade paper production.

VIII. Goal: Encourage Recycling and Reuse

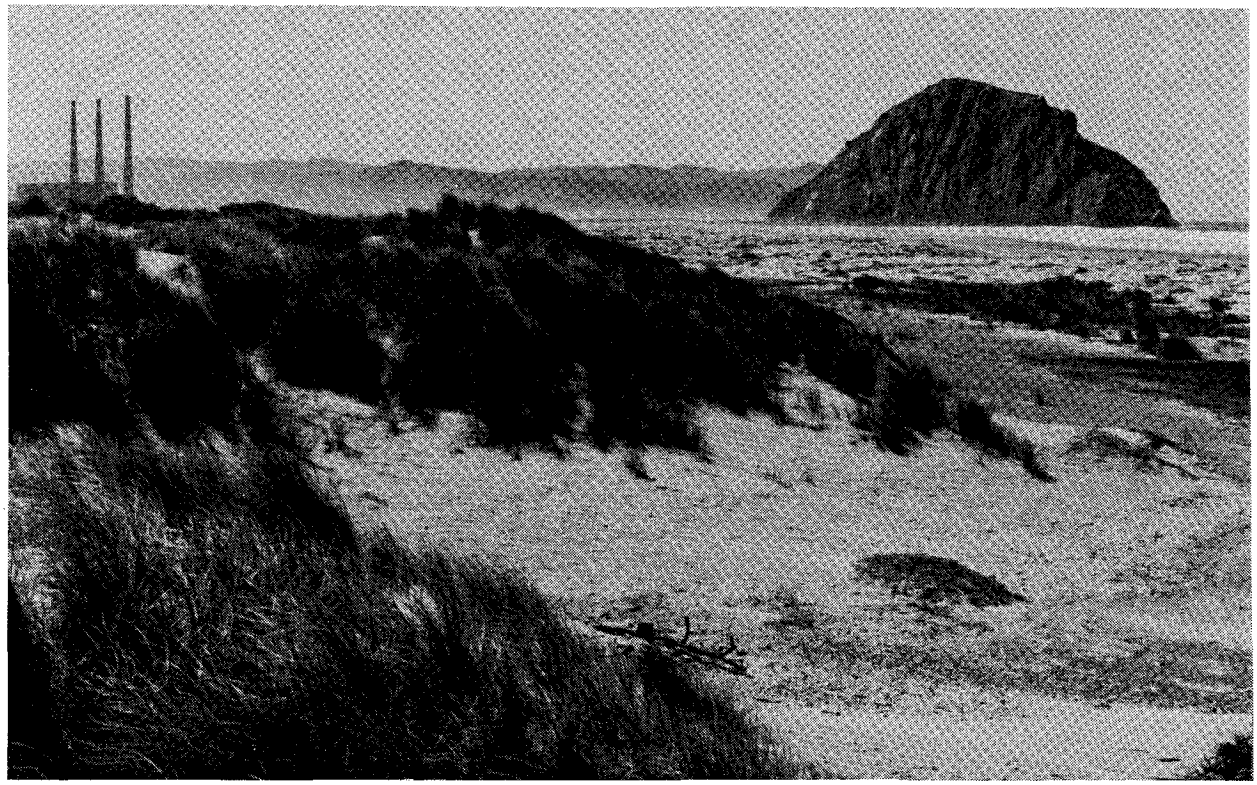
Policy 27. Encourage source reduction and recycling of solid waste generated in the county to reduce energy consumption.

Program 27.1. Research the feasibility for using recycled materials as alternative paving materials, i.e. automobile tires and toilets. Light-colored aggregate should be considered in new road construction and repaving projects in areas north of the Cuesta Grade and adjacent to existing cities and in some of the communities, such as Templeton, San Miguel, Creston, Shandon, and Santa Margarita.

Program 27.2. Develop a program to recycle all construction and demolition activities for which a permit is necessary to separate, recycle, and/or reuse waste materials. Projects should provide storage locations for recyclable materials.

Program 27.3. Develop an environmental resource guide that identifies where recycled or renewable construction materials can be purchased and explains why these materials are important to use. The guide should be provided to builders and developers throughout the county.

CHAPTER 4: ELECTRICITY GENERATION AND TRANSMISSION



This chapter covers electricity generation and transmission facilities in the county. The discussion is divided between facilities that operate on renewable fuel sources (such as solar, hydroelectric, wind, and biomass fuels) and those that operate on non-renewable fuels (such as uranium, oil, and gas). This is followed by a discussion of cogeneration facilities.

There are two utility-scale electricity generation facilities in San Luis Obispo County, the Morro Bay Power Plant and the Diablo Canyon Nuclear Power Plant, both owned by Pacific Gas and Electric (PG&E). At the time of their construction, these power plants were sited and permitted by the state and federal governments. In the past, local governments have had little jurisdiction or ability to regulate the siting of large scale facilities. Two smaller gas and oil power plants in the county are classified as cogeneration facilities. A solar photovoltaic plant in the eastern portion of the county is currently being dismantled.

General Facility Siting

Any power generation facility development will result in some disruption of the natural environment. There are some areas that the Coastal Commission has specifically identified as

unsuitable for future power plant construction. These areas are noted in Figure 4-1. There are some issues that are common to all electricity generation facilities. In particular, three issues often arise in the siting of generating facilities. These areas of concern are: compatibility with surrounding uses, site disturbance, and cooling water availability.

Compatibility with Surrounding Uses

Energy conversion power plants (facilities that use a natural resource such as gas, oil, or uranium and convert it to electricity) are generally industrial-type land uses. Such facilities may generate excessive heat, noise, and/or odors that can be offensive or hazardous to downwind populations. Conversion facilities should generally be located in areas suitable for industrial development and away from sensitive land uses such as residential, commercial, or recreational areas, and sensitive wildlife habitats.

Site Disturbance

Construction and operation of electricity production facilities necessarily disturb the sites they occupy. A common objection to facilities is the visual impact on the surrounding landscape. Excessive grading and land disturbance can result in erosion problems that are difficult to rectify. Loss of habitat or other wildlife impacts may be significant. Noise is sometimes a consideration as well.

Cooling Water

Some energy processes (solar thermal, biomass combustion, fossil fuel, uranium) convert heat into electricity by using steam or some other substance to turn a turbine. Cool water is typically needed to condense the steam and turn it back into water so that the cycle can be repeated. A reliable supply of cooling water is therefore a constraint on thermal facilities. Monitoring the impacts cooling water has on biological communities when it is returned to its source is an important activity. The exact amount of water use will depend on the type, size, and efficiency of the facility. Therefore, the availability of water and the relative merit of competing uses is an issue in the siting of thermal electric facilities.

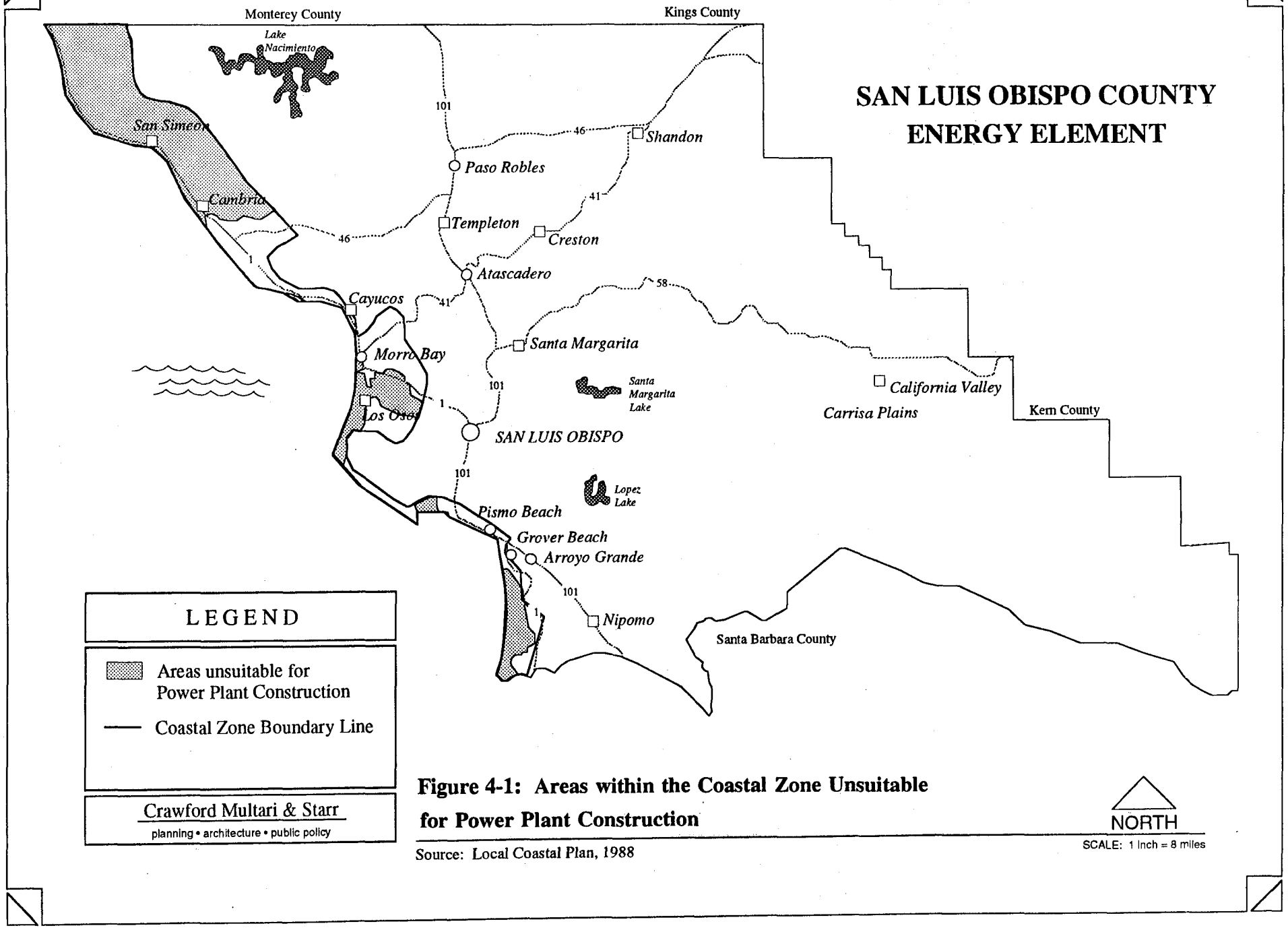


Figure 4-1: Areas within the Coastal Zone Unsuitable for Power Plant Construction

Source: Local Coastal Plan, 1988

The Future of Electricity Generation

All electric utility providers are required by state law and the California Public Utilities Commission to maintain a reliable and least costly supply of electricity to the rate payers in their district. Many utility companies anticipate that the future of energy production will change from dependence on large centralized power plants to reliance on smaller, more localized producers. Instead of building large power plants, smaller units that meet the need of the locale or region will be installed.[5] In this scenario, a variety of facilities and sources will likely be used, rather than relying on one technology. For example, the energy mix of the future could include solar systems, wind energy conversion systems, hydroelectric, biomass, cogeneration, advanced steam turbines, advanced gas turbines, and fuel cells.

This new approach of the future would require that utility providers work together with state and local regulatory authorities to:

- Consider a full range of resource alternatives, including, in preferential order:

  1. conservation and efficiency,
  2. renewable energy supply resources.
  3. cogeneration and last, and
  4. high efficiency fossil fuel facilities.

- Consider and monitor regional needs and plans in relation to regional and global environmental impacts;

- Evaluate resource alternatives on a consistent basis, quantifying features of cost, environmental impact, diversity, risk, reliability, and long-term economic benefit;

- Implement regulatory reforms such that a utility's resource plan is its least-cost course of action and is also its most profitable course of action. At a minimum, utilities' prudent investment in conservation and efficiency measures should be profitable, but not at the expense of public health and safety.

- Develop alternatives to traditional rate structures which permit utilities to have reasonable opportunities for profitability in a more competitive environment while continuing their resource planning programs.

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[5] In the past, new generation facilities have been built by large utilities. The California Public Utilities Commission has recently changed it so that individual companies may bid on power plant construction permits. It is likely that the bids to construct will go to newer, smaller companies that will have significantly lower overhead costs.

- Write an action plan to ensure appropriate research and development expenditures, sustained orderly development of resource bases, and monitoring and evaluation protocols to check progress.

- Periodically evaluate the results in light of the action plan.

The future may bring a variety of electricity generating facilities that are smaller in scale and located closer to end users of power. Local agencies may be responsible for permitting and siting these facilities. By encouraging the development of renewable, local sources of energy, we can enhance the overall environmental and economic quality of the county. The following policies, guidelines, and programs will help prepare the county for dealing with a variety of different electricity projects.

Electric and Magnetic Fields

Wherever electricity is used, electric and magnetic fields are present. Because there is a relationship between electric and magnetic fields they are often termed electromagnetic fields (EMF). Wherever there is a flow of electricity, both electric and magnetic fields are created. Examples include appliances, lighting, and other electrical uses in homes, schools and work places. Transmission and distribution lines which transport electricity also produce both electric and magnetic fields.

Electric fields are created by voltage, and higher voltage produces stronger electric fields. An electric field exists near any line that carries electricity and any appliance that is plugged into an electrical outlet. Electric fields are measured in volts per meter (V/m). The intensity of electric fields is directly related to the amount of voltage flowing through a conductor and the distance from the source of the field. Electric fields can be shielded by objects and materials.

Magnetic fields result from current flowing through wires from one place to another. Magnetic fields are typically measured in gauss. Milliguass, one-thousandth of a gauss, is the measurement used most often when fields are evaluated. The strength of a magnetic field depends on the amount of current flowing through, and the configuration of, the conductor(s). A conductor can be a transmission line, an electric cord from an appliance, or any other device that conducts an electric current. Magnetic fields pass through most objects or materials, but their magnitude decreases rapidly with distance.

The health effects of electric and magnetic fields on humans are not clear. Some studies have suggested that an association between EMFs and certain cancers may exist. Other studies have shown that various cellular activities are affected by EMFs. The findings of many studies have been controversial, with no clear identification of a cause-and-effect relationship.

The question about the health affects caused by EMFs has yet to be conclusively answered. According to the California Department of Health Services, a number of research studies are underway to determine if EMFs pose health risks, and, if so, what aspect of the field is harmful.

However, enough scientific information links them with health affects that taking measures to avoid exposure is warranted.

The present California Energy Commission approach to 60 Hz[6] field control is to ensure that public exposures to fields from future transmission lines do not exceed those associated with the presence of existing lines. The present standard is to limit the strength of the electric field to 1.6 kilo volt per meter (kv/m) at the edge of the line right-of-way.

Definition of Goals, Policies, Guidelines and Programs

The policies and guidelines in this document are intended to serve as an educational resource for projects that require only ministerial approval. For discretionary projects, projects that need a public hearing, the element provides guidance and a range of alternatives for achieving the stated goals.

The goals, policies, guidelines, and programs contained in the *Energy Element* provide the foundation for reviewing energy related projects for consistency with the general plan. They also provide guidance for incorporating energy conservation and efficiency measures into other development projects. The following definitions identify the differences between a goal, policy, guideline, and program:

Goal

Goals are a general expression of community values, an ideal future result, or condition, related to public health, safety, or general welfare. Goals provide the vision statement of *what* is desired in the future.

Policy

Policies are more specific than goals. Policies are statements that guide decision making. Policies are based on the information gathered and analyzed during the process of developing the element.

Guideline

Guidelines provide direction on *how* to implement the goals and policies contained in the general plan. While guidelines may provide specific direction for addressing a particular issue, alternative approaches that achieve the same result may also be used.

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[6] Hz—Hertz. The number of times that alternating current changes direction (cycles) while traveling through the conductor. In this case, the current is traveling at 60 cycles per second.

Program

Programs are actions that may be initiated by the county or other public agencies to achieve specific community objectives. Because programs are recommended actions rather than mandatory requirements, county implementation should be based on consideration of community needs, support for the program, its related cost and available funding.

IX. Goal: Protect Public Health, Safety and the Environment

Policy 28. In meeting the electricity needs of San Luis Obispo County:

- First preference shall be for increased use of conservation and efficiency measures in all sectors of electricity use.
- Second preference shall be for facilities to use renewable resources such as wind, solar, hydroelectric, biomass and geothermal.
- Third preference shall be for fossil fuel cogeneration facilities that produce electricity and process heat for industrial uses.
- Fuel cells and high efficiency fossil fuel facilities should be considered.

Policy 29. Facilities shall be sited and constructed in a manner to protect the public from potential hazards and significant environmental impacts.

Facility Design and Operation

Guideline 29.1. Continue to maintain, operate, monitor, and repair the facility so that it does not constitute a public safety hazard or an environmental threat.

Guideline 29.2. All existing electrical distribution lines on the project site should be underground up to the transformer, to the point of on-site use, or to the point of interconnection to the utility. California Public Utilities Commission standards should be considered during the review process.

Guideline 29.3. Reduce the risk of hazardous material releases at power producing facilities consistent with requirements of the California Health and Safety Code sections 25500 through 25553. Methods of risk reduction should include: 1) use of non-hazardous or less hazardous material, 2) use of engineered safety systems, and 3) use of administrative controls.

Guideline 29.4. The county's emergency response plan and Office of Emergency Services should be consulted prior to operation of a facility. Local fire departments should also be contacted.

Site Location

Guideline 29.5. Identify the route of existing and proposed transmission lines serving the project. Follow the guidelines for transmission lines established under Policy 51.

Guideline 29.6. Employ the best reasonably achievable techniques available to mitigate impacts to environmentally sensitive areas such as wetlands, animal or bird refuges, or habitat of species of special concern. Avoid impacts to habitat of rare, threatened, or endangered species.

Guideline 29.7. Within a sensitive view corridor, scenic, or recreational area, employ the best available techniques to mitigate impacts related to these resources consistent with guideline 29.6.

Guideline 29.8. If the proposed location visually impacts a home site, prepare a screening plan to minimize visual impacts.

Guideline 29.9. All exterior lighting should be energy efficient and shielded to not extend beyond the site.

Guideline 29.10. Avoid or otherwise mitigate impacts to significant archeological, paleontological, or historic resource sites.

Guideline 29.11. Locate proposed facilities in a geologically stable area, or all significant impacts from erosion, landslides, and seismic activity should be mitigated to insignificant levels.

Construction

Guideline 29.12. Minimize the removal of mature trees and overall surface disturbance. The removal of natural vegetation during construction should be kept to a minimum.
Guideline 29.13. Revegetation planting shall be required and maintained after construction to curtail soil erosion on sloping sites and should occur prior to the winter rainy season. Where appropriate, native plant species should be utilized.

Guideline 29.14. Obtain written permission or documentation to use an access way from the land owners. Include land owners early in the planning process. Also, construction shall be scheduled in cooperation with the affected farmers.

Guideline 29.15. Allow for continuous land owner use of permanent access roads. Unauthorized parties shall be prohibited.

Program 29.1. Amend applicable ordinances to determine when a proposed land division should provide measurements of electric and magnetic fields for transmission line rights-of-way. Applications should include measurements and calculations of electric and magnetic field strengths where applicable.

Program 29.2. Amend applicable ordinances to require the following development standards:

- All wire fences, metal buildings, and metal objects adjacent to transmission lines should be grounded in accordance with the standards adopted by the California Public Utilities Commission and the Division of Occupational Safety and Health.

- New rural residences built on parcels adjoining power lines should be sufficiently set back from the conductors.

- New public gathering places such as schools, churches, hospitals, and civic buildings should not be located near power line easements or rights-of-way.

Policy 30. Proposed electricity facilities must provide a sufficient buffer zone from existing or proposed human populations, with special consideration given to those who cannot be quickly evacuated to safety, such as the disabled and elderly.

Policy 31. Encourage the upgrade or replacement of existing, older facilities to current safety and environmental standards. Further develop a cooperative working relationship with the utility industry, including workshops to provide information about the permitting process.

Policy 32. Coordinate with state and federal agencies to promote an information exchange about safety standards and regulations with regard to electricity facilities.

Policy 33. To minimize human exposure to potential hazards of large transmission lines, allowable land uses that may expose human populations to undue risk should be discouraged.

Policy 34. Continue to monitor the research and policy developments concerning electric and magnetic fields. If exposure standards are established in the future by state and federal agencies, such standards should be considered for inclusion into the general plan and applicable ordinances.

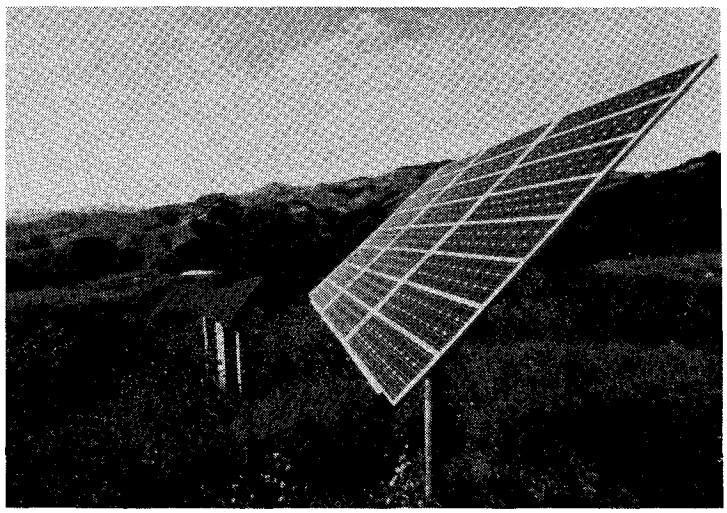
Policy 35. Consider electric and magnetic fields (EMF) in planning for expansion, siting and construction of future electric facilities. EMF standards established by the California Energy Commission and the California Public Utilities Commission (if any) should be applied.

Policy 36. Address the issue of electric and magnetic fields when reviewing proposed land divisions. Land developers should apply standards established by the California Energy Commission and Public Utilities Commission for EMF exposure in their developments.

Renewable Fuels

This section discusses the technology, available resource, and siting issues associated with solar energy conversion systems, biomass combustion facilities, wind energy conversion system, and hydroelectric facilities. In general, the county favors the use of such resources over the use of fossil fuel facilities.

Solar Energy



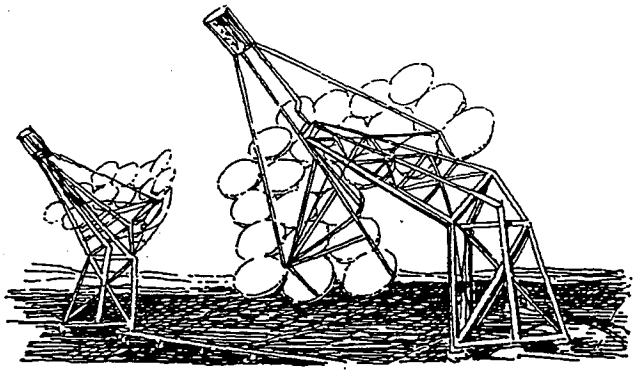
When speaking of "solar energy technology", we are referring to the direct conversion of sunlight into usable energy. Sunlight can be converted to electricity, or used directly to heat water or space. Some issues associated with solar space lighting and water heating were discussed in the previous chapter on *Buildings and Energy Use*.

The two major types of solar energy technology that generate electricity are photovoltaic and solar-thermal facilities. Photovoltaic solar facilities directly convert sunlight into an electrical current at a low voltage. Photovoltaic solar cells absorbs sunlight and converts it directly to electricity through the reaction of electrons within the cell. Electrical current can then be withdrawn from the cell and stored in batteries, used on-site, and/or fed into transmission lines (after being converted from direct current to alternating current in most cases).

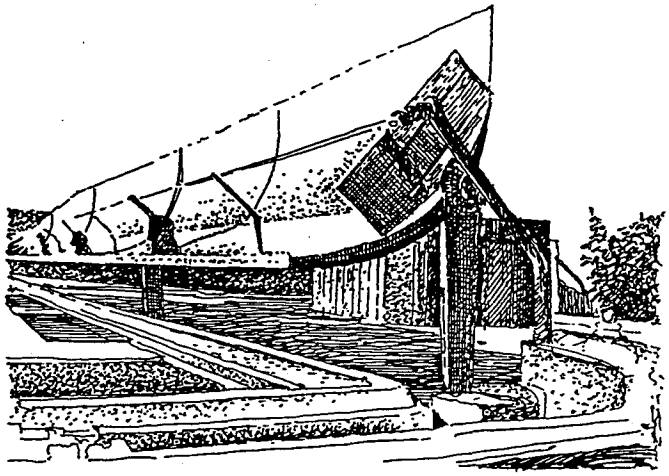
Solar thermal technology first collects and concentrates solar energy and then converts the energy into electricity. Most commonly, a highly reflective surface is used to focus solar energy on a heat collecting pipe (called the "receiver"). A fluid circulates through the receiver, collecting the thermal energy and transferring it to the power block of the plant for the generation of electricity. If the fluid is water/steam, then the fluid is used to drive a turbine directly. If the fluid is a heat transfer material, such as oil or liquid sodium, then the fluid transfers its heat energy to water to make steam in a heat exchanger, called the *steam generator* (CEC, 1991). Methods used to concentrate sunlight include 1) parabolic dish mirrors, 3) mirrors arranged in parabolic troughs, or 3) distributed mirror array focused on central receiver system (see Figure 4-2).

Figure 4-2: Solar Thermal Collection Facilities

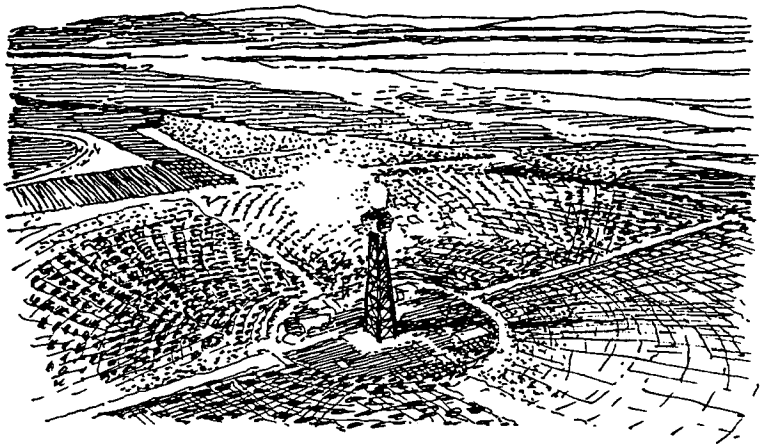
Parabolic Dish Mirrors



Parabolic Trough



Power Tower



Source: Association of Bay Area Governments, Small but Powerful, 1987.

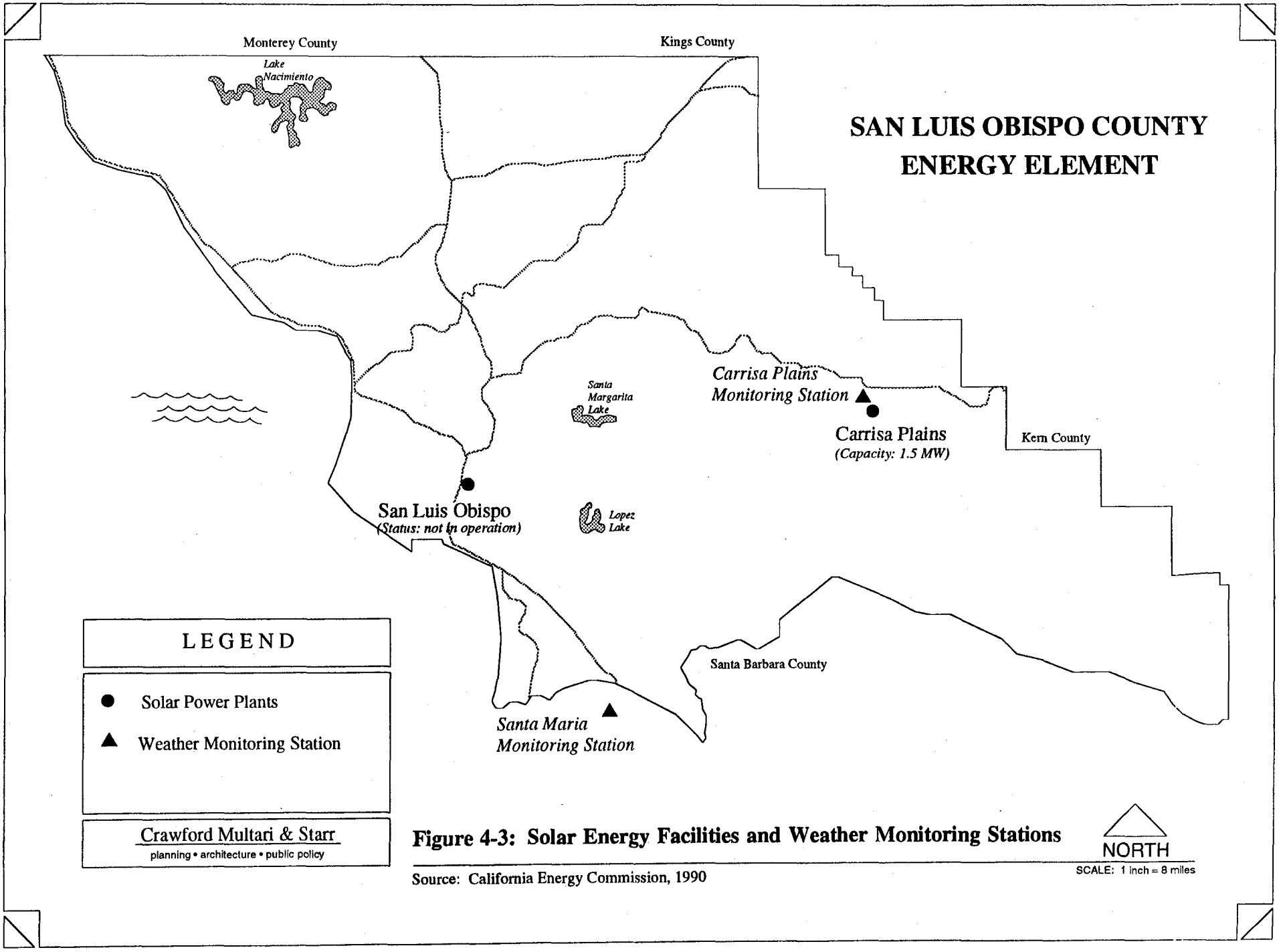


Figure 4-3: Solar Energy Facilities and Weather Monitoring Stations

Source: California Energy Commission, 1990

Solar energy boasts the largest resource potential of any energy source in the county. In particular, the Carrizo Plains is a unique solar resource (see Figure 4-3). It is one of two potential locations in California that do not get coastal fog during the summer or ground fog during the winter. The only other area in California with greater solar potential is the Mojave Desert.

The amount of sunlight that could be collected and converted into energy is constrained only by the economics of building large energy conversion plants and the efficiency of such facilities. Even so, it appears that more than enough solar energy could be generated to satisfy the county's need for electricity.

Photovoltaic and passive solar systems are relatively small and extremely reliable, do not require cooling water, require little or no maintenance, and are located near the load they serve. This avoids transmission impacts, and site impacts are minimal. Water pumping, grid voltage support, and power for remote locations off the grid are examples of photovoltaic system use which may be appropriate for San Luis Obispo County. Passive solar applications and designs can be used on any new or existing structure.

The solar resource available in the Carrizo Plains gives San Luis Obispo County the opportunity to make a bold statement regarding the development of renewable energy facilities. It is likely that within the next 15 to 20 years, it will become cost effective to development a solar thermal facility on the Carrizo Plains. The county may be able to accelerate that time line by providing clear guidelines, procedures, and possibly incentives for the development of such a facility. Likewise if photovoltaic-technology efficiencies improve, a large-scale photovoltaic facility may also be feasible on the Carrizo Plains.

Biomass Fuels

San Luis Obispo County has a sizable amount of biomass potential (2.9 trillion Btu/yr). (See *Renewable Energy Issues Working Paper* for more details.) There are two biomass facilities in the county as shown on Figure 4-4. These facilities are part of cogeneration systems and are discussed later in this report.

Biomass refers to various organic waste products from agricultural and industrial processes. When using biomass materials that would normally enter municipal landfills, the process is often called waste-to-energy conversion. The most simple biomass conversion facility is the typical fireplace, furnace, or wood-burning stove. The wood is burned to provide space heating. Although simple, and often aesthetically pleasing, this form of biomass conversion uses a fairly high-grade fuel source (dry wood) and can sometimes be an inefficient heating mechanism.

More complicated biomass thermal conversion techniques involve burning flammable materials to boil water and generate steam, which then drives steam turbine-generators to generate electricity. Waste products with higher moisture content, such as animal manure and wastewater treatment sludge, can often be used in modified steam boilers. Mass burn systems use minimal processing of the waste prior to incineration. Large-scale mass burn systems typically have capacities up to 3,000 tons per day of municipal solid waste.

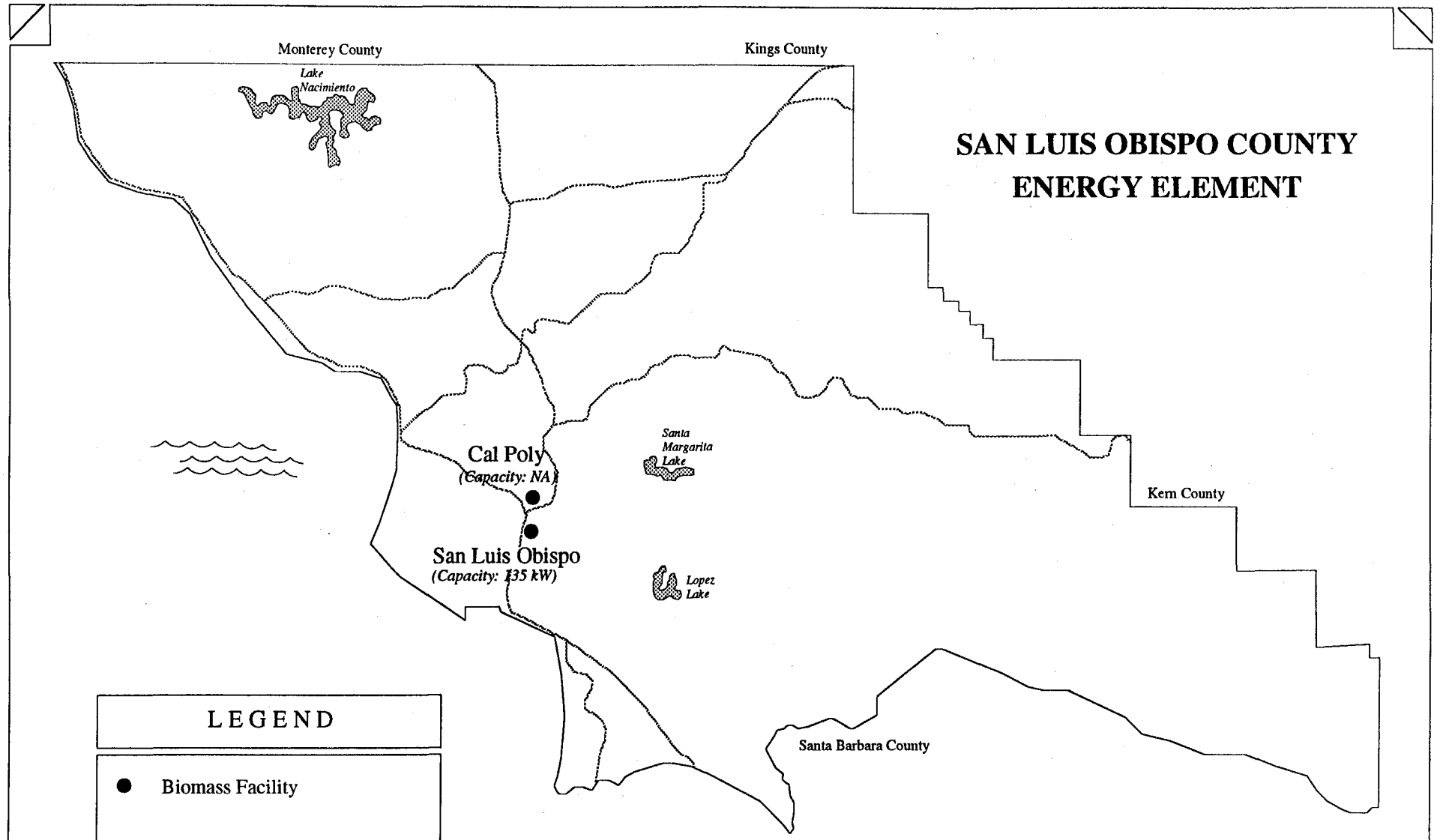


Figure 4-4: Location of Biomass Facilities

Source: Crawford Multari & Starr, 1993

Small scale mass burn systems typically use less than 500 tons per day and are ideally sited to small communities of 25,000 to 250,000 people.

Another thermal conversion technique is gasification, also known as *pyrolysis*. Pyrolysis exposes a biomass source to high temperatures while limiting the amount of oxygen. A second method uses biological methods to create biogas. The municipal waste is placed in a chamber where anaerobic digestion (the bacterial digestion of organic materials in the absence of oxygen) produces biogas. (Liquefaction is another type of gasification where the final product is a liquid fuel instead of gas.) The biogas can then be 1) captured and used directly like natural gas, or 2) burned to drive steam turbines which then generate electricity.

When siting a biomass facility, collecting the fuel is the main issue of concern. To efficiently collect livestock manure for use as a biomass fuel, 50 to 80 percent of the animals must be confined within a relatively small area; dairy farms, feedlots, and chicken farms in the area may best meet this requirement. For example, the proposed chicken farm in the north county area and the feedlots at California Polytechnic State University for cattle, pigs, sheep, and chickens may be good candidates for biomass conversion facilities (Williams, personal communication). The biomass facilities may even benefit from a cogeneration facility.

Almost any sort of biomass can be burned to produce heat, steam, and electricity. The direct combustion of biomass however, results in pollutant emissions such as nitrogen oxides, reactive organic gases, and particulates. The problem may be particularly severe for facilities burning raw municipal wastes, which can contain toxic ash that must be safely disposed of.

Waste-to-energy facilities tend to be more expensive than some other forms of electricity generation, but they have the added benefit of extending the life of municipal landfills. Biomass may become a more attractive option for energy conversion in the future as state waste management standards take effect. AB 939 requires that 25 percent of wastes be diverted from municipal landfills by 1995 and 50 percent be diverted by the year 2000. The 25 percent reduction can probably be achieved through recycling and consumer education programs. To achieve the 50 percent reduction goal, the county will probably have to institute a composting or waste-to-energy conversion program. However, the requirement needs of the waste-to-energy facility should not allow burning wastes such as paper, newspaper, and cardboard.

Wind Energy

San Luis Obispo County has only a few areas suitable for large scale wind energy conversion system (WECS) development (see Figure 4-5). Wind turbines consist of blades, rotor, transmission, electrical generator, and control system, all mounted on a tower. Wind causes the blades to rotate, generating mechanical energy that is converted to electrical energy by a generator. The blades of most wind turbines rotate in a vertical plane (horizontal axis), although some wind turbines rotate about a vertical axis. Most wind/electric turbines have either two or three blades made of fiberglass, laminated wood, or aluminum. These blades are mounted on tubular or lattice towers. Wind turbines may be connected to a utility grid system as single units or grouped into arrays.

There are numerous advantages to wind-generated power: the generators do not emit pollutants to the air or to water resources; water is not needed in the production cycle; and the machines are preassembled and can be installed relatively quickly.

Some individuals may elect to purchase a small-scale wind generator for private use. Wind energy could also be used for pumping water on a more widespread basis. Some individual applications may be successful in the areas with wind speeds of 11 miles per hour or faster. The monthly kilowatt hours on some generator models may be sufficient to power an agricultural pump or a home or small business.

At excellent sites, commercial wind generation has the potential to provide the lowest cost energy of all renewable resources (PG&E 1992). Unfortunately, there are no excellent sites in San Luis Obispo County, i.e., wind speeds averaging around 18 miles per hour. The only appropriate area for large-scale wind farm development is the coastal area between Point Buchon and Point San Luis. (In other locations with high wind speeds, the scenic values of the areas outweigh the possible benefits of wind power development.) There are still a number of constraints at this site:

- There are a number of archaeological sites that may limit the number of suitable locations for wind towers.

- Given the current state of wind energy conversion technology, the site is only moderately suitable for large-scale wind generator development.

If, as suspected, there is unidentified potential in the remote areas of the Paso Robles/Salinas Valley area, such locations may be more appropriate for WECS development. Aesthetics along the Highway 101 corridor will be an important consideration in permitting any wind towers.

If the technology improves to the point where large-scale wind farm development is practical, the county should carefully consider any large-scale wind energy conversion systems requests.

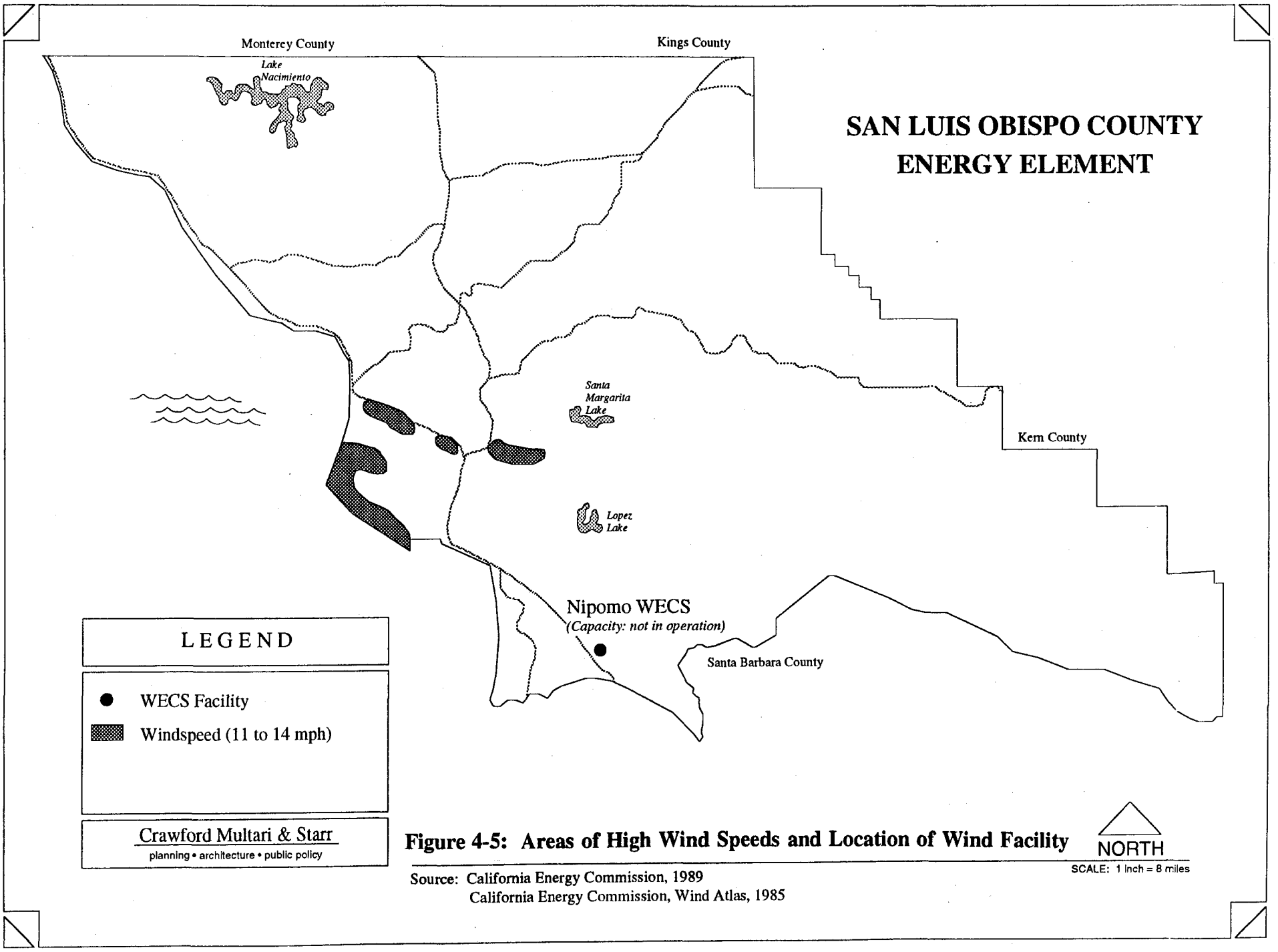


Figure 4-5: Areas of High Wind Speeds and Location of Wind Facility

Source: California Energy Commission, 1989
California Energy Commission, Wind Atlas, 1985

Hydroelectric Energy

Existing hydroelectric facilities on reservoirs include Lopez Lake, Lake Nacimiento, Whale Rock Reservoir, and Santa Margarita Lake, as shown on Figure 4-6. San Luis Obispo watercourses with hydroelectric potential include the Salinas River, Santa Margarita River, and San Luis Creek. Stenner Canyon is also the site of a facility. The state water project may include one hydroelectric facility near the base of the Cuesta Grade.

Hydroelectric facilities utilize the energy of moving water. Most facilities use a dam or diversion structure to control water so that, as the water falls, it turns a turbine. The mechanical energy associated with the movement of the turbine is then converted into electricity via a generator attached to the turbine. The water must have sufficient energy to move the turbine (called "hydrostatic head"). For this reason, most large-scale projects are located at a dam or reservoir where the hydrostatic head can be confined to a compact area. Smaller scale projects can be sited along streams or inside water pipelines coming down steep hillsides, where hydrostatic head is created by the natural change in elevation.

Impacts of hydroelectric projects are related to the construction of dams and the diversion of water from existing riparian corridors. In San Luis Obispo County, dams and diversions are primarily to augment water supplies, not energy. When energy can be captured incidentally (e.g. in-pipe systems) from the operation of water facilities, it has few, if any, additional impacts.

Such hydroelectric facilities may impact hydrology by: changing stream flows; changing the amount of groundwater recharge; affecting water turbidity (the amount of sediment in the water) and oxygen content; and altering water quality and quantity, thereby adversely impacting aquatic life. Hydroelectric facilities are generally located on steep, visible slopes to take advantage of hydrostatic head. This may require converting a free flowing natural stream landscape to an industrial-looking facility.

Geothermal

Historically, San Luis Obispo County has made direct use of geothermal energy from hot springs located near Paso Robles and Avila Beach (see Figure 4-7). The county's geothermal energy could be used as a supply of low temperature heat in areas like Paso Robles. Such systems would have minimal impacts so long as the mineral content of waste water from the system is carefully evaluated. In some instances, geothermal fluids may have to be reinjected into the geothermal reservoir.

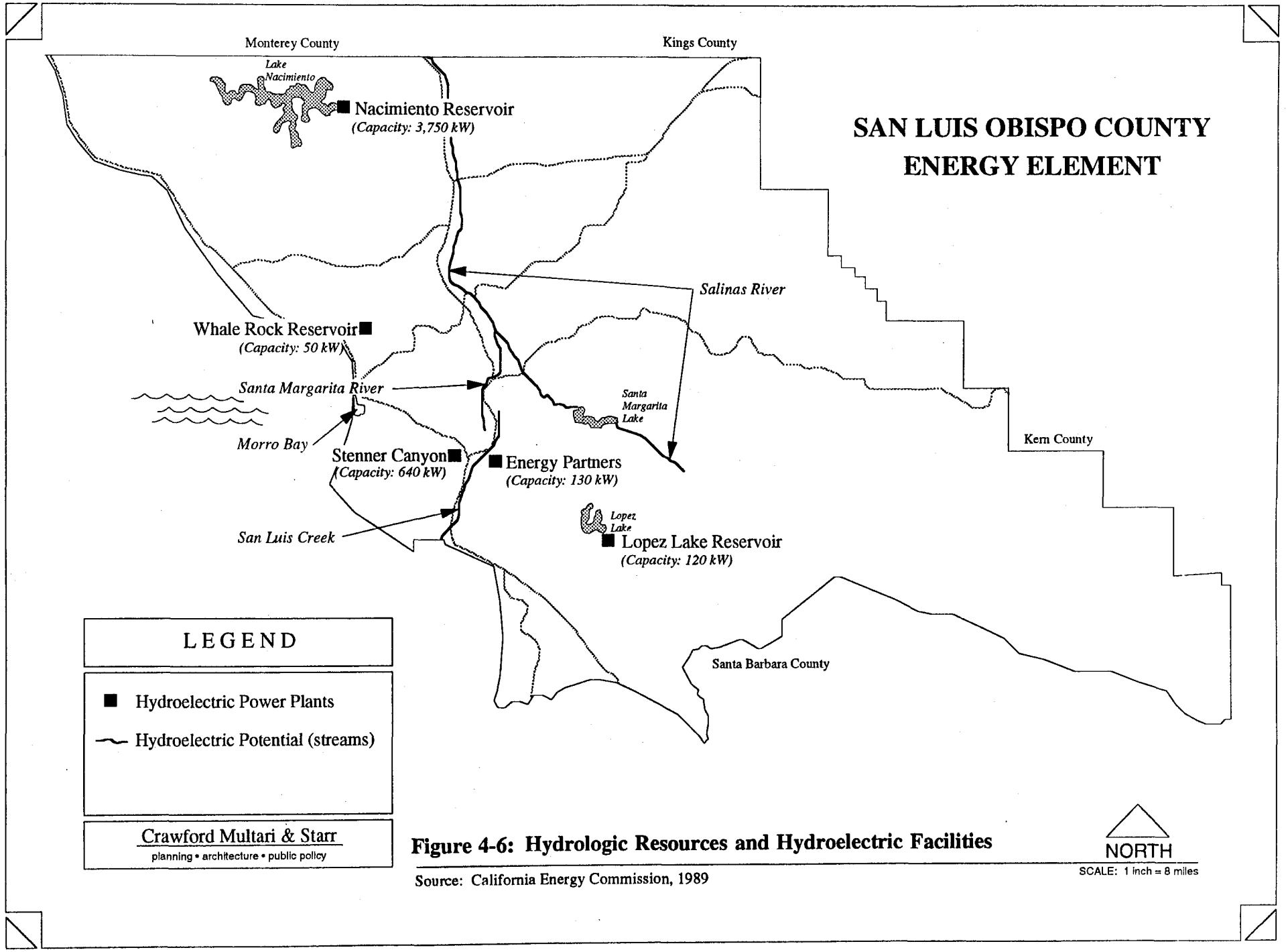


Figure 4-6: Hydrologic Resources and Hydroelectric Facilities

Source: California Energy Commission, 1989

X. Goal: Encourage Renewable Energy Projects

Policy 37. The development of sustainable energy sources and renewable energy projects shall be encouraged.

Policy 38. Encourage the use of solar electric power generating facilities, especially in areas remote from utility services and in places where such systems can meet specialized power needs cost effectively.

Policy 39. Encourage and support the development of solar power systems as commercial energy enterprises where visual and environmental impacts can be mitigated. The following guidelines should be applied to solar facilities over 10 kW:

Guideline 39.1. Solar facility development shall be subject to the guidelines under Policy 29.

Guideline 39.2. The proposal for the solar facility shall identify the source of sufficient quantities of water, if any, necessary to operate the facility.

Site Design

Guideline 39.3. The applicant shall submit a complete description of the type of solar facility that will be employed, including an analysis of the tracking system (if appropriate) showing that no concentrated reflections are directed at occupied structures, recreation areas, or roads.

Guideline 39.4. Because solar power systems can create high concentrations of heat and light, conditions shall be placed on the design and operation of the proposed facility to reasonably mitigate any adverse effects on birds, fish, and other wildlife or their habitats.

Policy 40. Encourage waste-burning biomass facilities as a method of producing electrical energy where environmental and air quality impacts can be mitigated and the facility is compatible with adjoining uses.

Guideline 40.1. Biomass facilities shall be subject to the guidelines under Policy 29.

Guideline 40.2. Identify the specific location and type of fuel source for the biomass facility and the method of gathering and delivering the fuel to the site.

Guideline 40.3. Identify the quantity of and type of wastes expected to be generated by the biomass facility. A preliminary agreement with a suitable disposal site to accept the

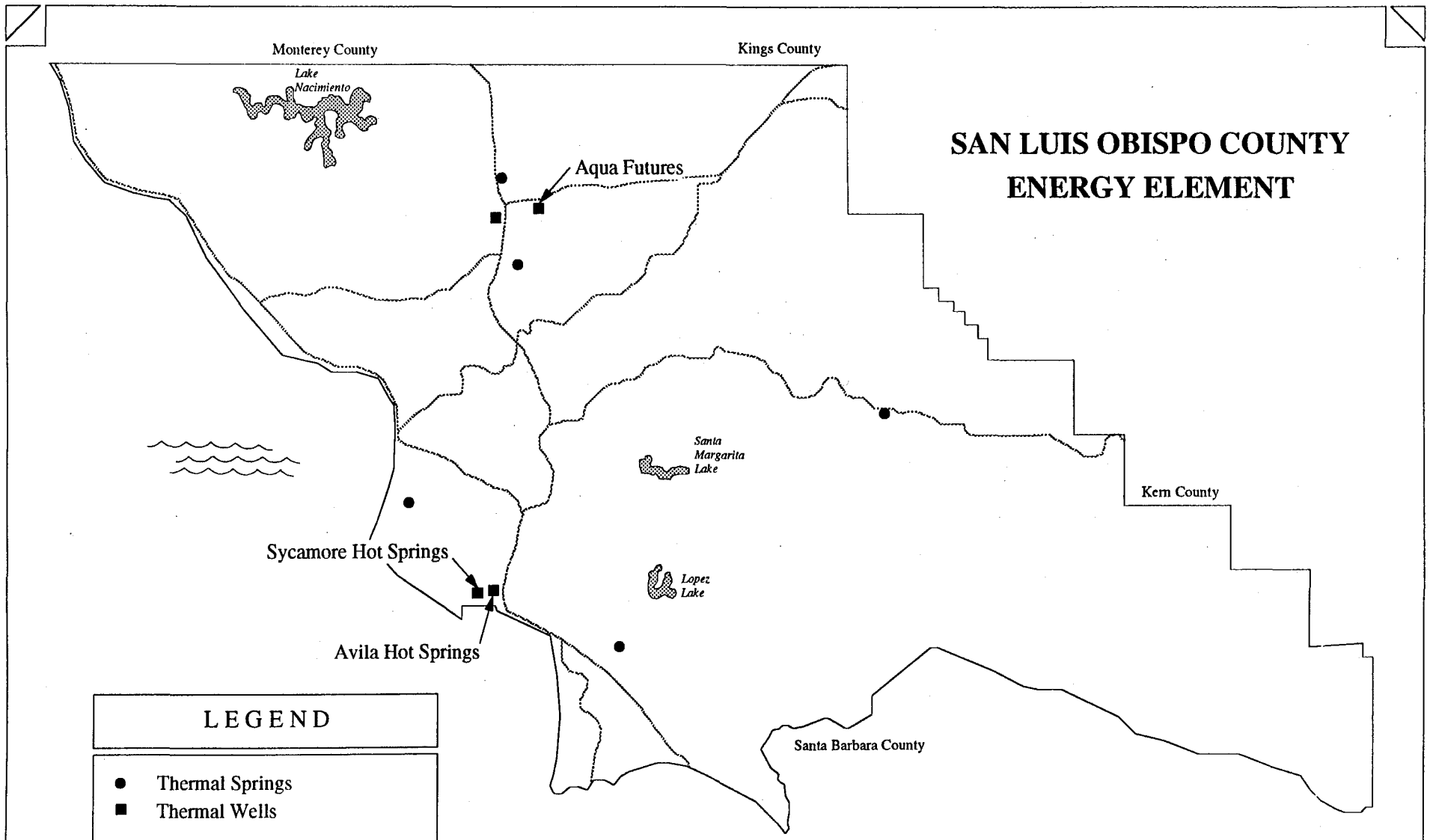


Figure 4-7: Geothermal Energy Resources and Facilities

Source: Division of Oil and Gas, 1988

wastes should be in place. Paper and cardboard (which can be efficiently recycled) should not supply more than 25 percent of the fuels for the facility. Mass burn facilities should not be allowed to use demolition waste which contains hazardous materials as a fuel source.

Guideline 40.4. Include a plan for the handling and disposal of hazardous materials which may be contained in the waste products.

Guideline 40.5. Address the long-term availability of fuel for the project.

Site Location

Guideline 40.6. Identify the source of sufficient quantities of fuel and water necessary to operate the facility.

Guideline 40.7. Locate near a railway, or near roadways that can handle the size and frequency of trucks need to transport biomass fuels and wastes into the facility without diminishing the roadway level of service below the acceptable level as stated in the *Land Use and Circulation Element.*

Guideline 40.8. Locate at least 1,000 feet away from hospitals or schools, excluding colleges or universities.

Guideline 40.9. Locate such that the fugitive dust from the proposed biomass fuel storage yard shall not impact business or residential uses downwind of the facility. The facility shall be subject to the regulations of the Air Pollution Control District.

Guideline 40.10. Limit the size of storage piles to approximately an area of 20 ft. x 40 ft. x 80 ft., or the applicant should demonstrate an appropriate stockpile watering program that uses recycled and/or non-potable water.

Policy 41. Encourage wind energy development where visual and environmental impacts can be mitigated and adequate site analysis is completed.

Policy 42. Encourage development of hydroelectric facilities which mitigate environmental impacts, including the availability and quality of water and fish habitat.

Guideline 42.1. Hydroelectric facilities shall be subject to the guideline under Policy 29.

General Performance

Guideline 42.2. Major earthwork associated with construction should be scheduled during the dry season.

Guideline 42.3. Approval should not be granted until the Regional Water Quality Control Board and Department of Fish and Game have reviewed the stream-flow requirement and conditions have been placed on the proposed facility to mitigate any adverse effects on fish and wildlife or their habitats.

Guideline 42.4. Water should not be diverted from a stream that provides habitat for listed or candidate species of threatened or endangered status, nor if the stream is an important spawning area or supports other important fishery resources.

Guideline 42.5. Design turbine intakes of the proposed facility to decrease fish loss.

Site Location

Guideline 42.6. Avoid significant adverse impacts on the riparian vegetation along the project waterways unless full restoration of impacted areas will be completed.

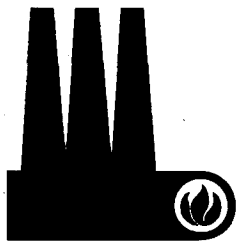
Guideline 42.7. Regional recreational opportunities (swimming, boating, fishing) shall not be adversely affected by the proposed facility unless such impacts have been offset or otherwise mitigated.

Policy 43. Encourage the use of geothermal hot water for heating spas, greenhouses or other beneficial applications. The mineral content of geothermal resources should be evaluated to determine the proper method of waste disposal. If necessary, the developers should install a system to re-inject the water back into the geothermal reservoir.

Non-renewable Fuels

This section discusses steam generating power plants, fuel cells, high efficiency combustion turbines, and hydrogen.

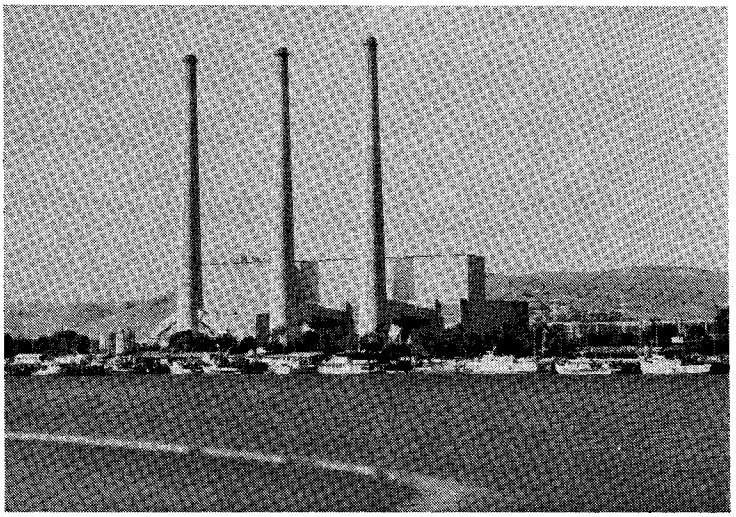
Steam Generating Power Plants



Steam generating power plants generally use oil, gas, coal, or nuclear fuels. (Coal facilities are unlikely in the county and are therefore excluded from this discussion.) It is the position of the county to discourage the use of non-renewable fuels and encourage energy efficiency, conservation, and the development of renewable energy resources.

Steam generating power plants convert heat into electricity by burning or otherwise releasing energy from the fuel to create heat which is then used to create steam. The steam is then used to turn a turbine which creates the electricity.

The two utility-level electricity generation facilities in San Luis Obispo County are the Morro Bay Power Plant and the Diablo Canyon Nuclear Power Plant, both owned by Pacific Gas and Electric (PG&E). The location of the facilities is shown on Figure 4-8.



Morro Bay Power Plant. The Morro Bay Power Plant is located in the City of Morro Bay and was constructed shortly after World War II to meet the increased demand for electricity caused by incoming California residents. There are a total of four generating units at the site, with a combined output of 1,002 MW. The first two units began producing electricity in 1955 and 1956 and have a maximum output of 163 MW each. The third and fourth units began to operate in 1962 and 1963, respectively. These two units have a maximum output of 338 MW each. The Morro Bay power plant primarily burns natural gas, although it can use fuel oil if necessary. At full capacity, the units use 146 million cubic feet of natural gas or 1.4 million gallons of oil per day.

Up to 492 million gallons of water are pumped out of Morro Bay each day and used to cool the steam that drives the turbines. The water is constantly flowing and this *once-through* system creates a steady stream of heated water that enters Estero Bay north of Morro Rock. The Morro Bay Power Plant also has desalinization facilities to provide water for the steam generation cycle, with a capacity for purifying 324,000 gallons of water per day.

Diablo Canyon Nuclear Power Plant. The Diablo Canyon Nuclear Power Plant is located on a coastal terrace at Diablo Canyon, between Montaña De Oro and Avila Beach, which is an unincorporated portion of the county. The site is accessed from Highway 101 via Avila Road, and several miles of private road constructed by PG&E. Pacific Gas and Electric has a 99-year lease from the Marre Corporation for approximately 7,500 acres. Construction of the Diablo Canyon Power Plant began in 1967 and the plant began operating in 1986. It is currently (1993) the largest energy facility in the county with a production capacity of 2,160 MW. The Diablo Canyon Power Plant represents about 19 percent of PG&E's total electric generating capacity.

The Diablo Canyon facility has two reactor vessels. Each vessel is inside a dome-shaped containment structure that stands 215 feet high and has a diameter of 147 feet. The facility uses a system of three water loops that do not come into direct contact with one another. The primary loop passes water through the reactor core to be heated. The water is under high enough pressure to prevent boiling, even though temperatures exceed 600 degrees. Before being recycled back through the reactor core, the water in the primary loop transfers its heat to the steam generator in the secondary loop. Here, water in the secondary loop is allowed to boil, creating steam. This steam is piped to the turbine-generator building, where it spins the turbine-

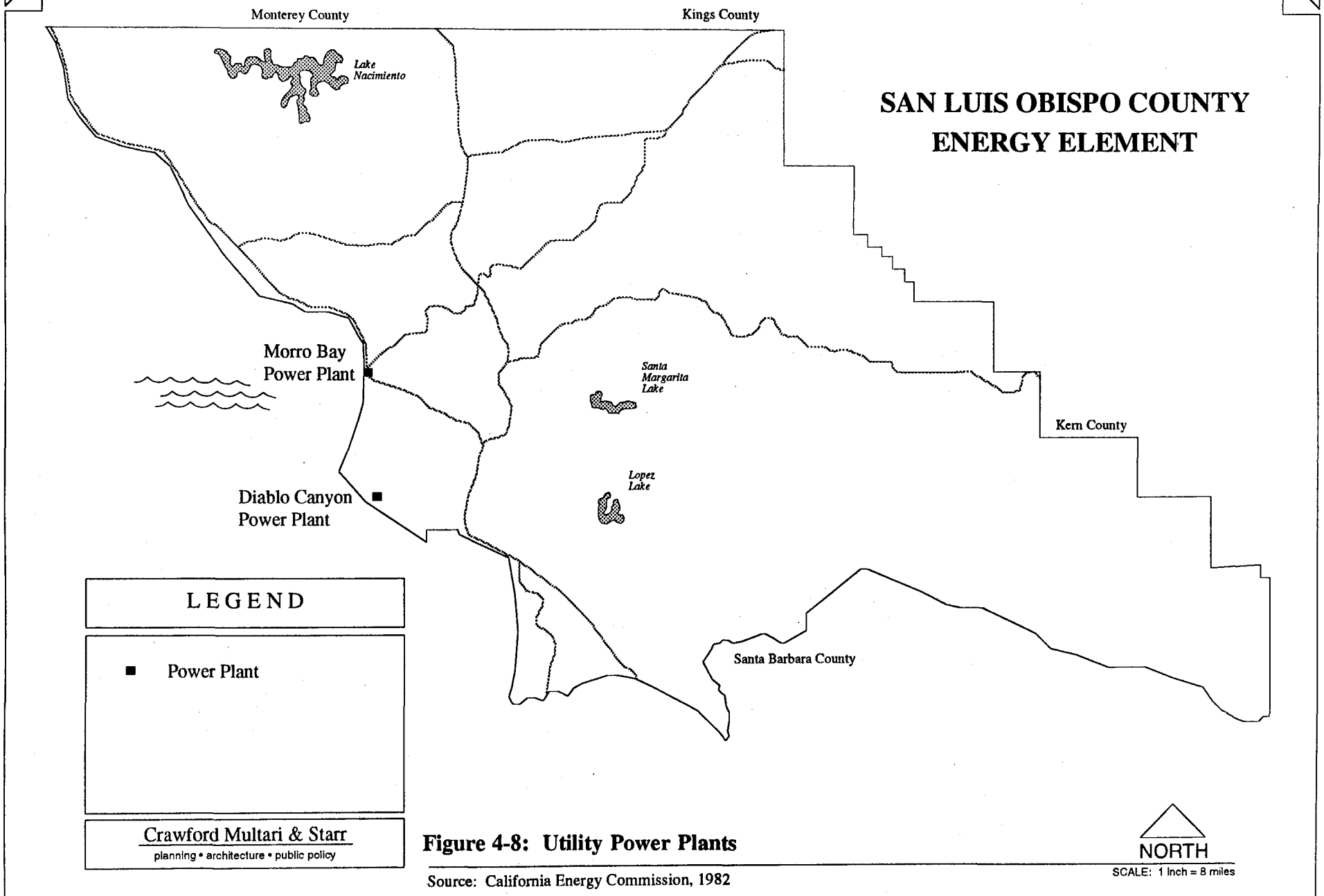


Figure 4-8: Utility Power Plants

Source: California Energy Commission, 1982

generator to produce electricity. The steam is then cooled by the water in the condenser loop and recycled back through the steam generator. The condenser loop continually draws water from a small inlet cove and discharges into a larger cove once it has been circulated through the loop. The discharged water is slightly warmer than the surrounding ocean water.

To support the purified water needed for the primary and secondary loops, Diablo Canyon has a sophisticated desalinization system. The plant has the capacity to process 648,000 gallons of ultra-purified water per day for peak period use. Some of this water is used for general plant operations to support the employees at the plant. The saline solution remaining after desalinization is injected into the outfalls along with the ocean water used in the condenser loop.

As mentioned previously, steam generating power plants require large amounts of water for conversion into steam and for cooling the combustion or fission processes. Air emissions from fossil fuel plant operations, can present problems. Burning oil results in significant air pollution emissions; natural gas burns cleaner, but still emits some pollutants. San Luis Obispo County is a non-attainment area for ozone and particulate matter, and the siting of new and/or expanded facilities must take potential emissions into account. Development of new or expanding existing facilities could result in both short-term and long-term increases in air emissions.

Radioactive wastes from nuclear facilities present especially difficult disposal problems. Transporting such wastes over any distance increases the potential for accidents and radiation exposure. With regard to pollutants and waste management, the project must comply with all applicable federal, state, and local laws, ordinances, regulations, and standards for non-hazardous and hazardous waste. Currently, radioactive waste is stored at the power plant in the spent fuel storage pool. The water in the pool acts as a radiation shield and coolant. This is meant to be a temporary storage situation until a permanent disposal site is found and approved by the federal government.

As this element was prepared, the technical advisory committee focused considerable discussion regarding how much detail should be included in the element to address the issues of nuclear facility siting and operations of exiting facilities. The level of detail in the element represents the following conclusions:

- The primary focus of the element is on issues that can be approved locally,
- The siting and operating of nuclear facilities is exclusively controlled by state and federal agencies, with limited opportunity for local control,
- Trends in the nuclear power industry indicate that few, if any, additional facilities are likely to be proposed in the foreseeable future,
- San Luis Obispo County is unlikely to be the site of another nuclear facility because of environmental concerns and resource constraints, and

- The safe transportation and storage of nuclear waste will likely be an important issue to county residents, as will the decommissioning, abandonment and reclamation of the Diablo Canyon site. The county should monitor these issues, provide input when necessary, and develop a more comprehensive policy direction as the need arises.

Finally, steam generating power plants are generally relatively large, industrial-type land uses that may be aesthetically unpleasant.

For these reasons, such facilities should generally be located in areas suitable for industrial development and away from sensitive land uses such as residential, commercial, or recreational areas, and sensitive wildlife habitats.

Fuel Cells

Fuel cells operate much like a battery, by transforming chemical energy into electrical energy directly, without a combustion process. Fuel cells require a continuous supply of hydrogen and oxygen. The cells produce direct current, which then must be passed through an invertor to create alternating current. Fuel cells are not yet commercially available, but they are expected to be a viable technology in the near future. The expected efficiency of these systems is about 40 percent. Fuel cells supplied directly with hydrogen and oxygen would produce no emissions. When a fuel other than hydrogen is used (for example, methane or methanol can be used in conjunction with an on-board reformer), there will be carbon dioxide emissions, and there could be very low levels of hydrocarbons, carbon monoxide, and nitrogen oxide emissions.

Because fuel cells could have no harmful emissions, small units could be established in individual neighborhoods to directly service the surrounding area. This would minimize transmission facilities and the energy lost through long-distance energy transmission.

High Efficiency Combustion Turbines

New technologies provide more efficient means to generate electricity from fossil fuels through advanced combustion turbines, including steam injected gas turbines, reheat gas turbines, and chemically recuperated gas turbines. As they are perfected, these technology advances are expected to permit electricity generation efficiencies of 55 percent or higher, compared to older utility power plants that typically operate in the 30 to 34 percent efficiency range (CEC, 1989).

Steam Injected Gas Turbines. In this technology, steam is injected directly into the gas turbine along with the air and fuel. Heat from the combustion exhaust system is captured and used as part of the heat input, thereby increasing the efficiency of the combustion system. The steam-injected gas turbine has a typical efficiency of about 44 percent and nitrogen oxide emissions are 70 percent lower than in simple cycle gas turbines. These commercially available gas turbines can be used in cogeneration applications.

Reheat Gas Turbines. In this technology, two combustors are separated by a first-stage turbine wheel. Fuel is ignited in the upstream combustor to drive the turbine wheel. Hot gases leaving the first stage are reburned by self-ignition as additional fuel is injected into a second, downstream combustor. Combined, sequential combustion drives the remaining turbine stages. When coupled to a heat recovery steam generator and a steam turbine (i.e., in a combined cycle configuration), this commercially available system can achieve a net efficiency of 57 percent.

Chemically Recuperated Gas Turbine. In this technology, a chemically treated, hydrogen-rich fuel (reformate) is burned to produce power. The gas turbine exhaust energy is used both in the reformer and in the steam generator, thereby increasing the efficiency of the conversion process. When combined with the intercooling and reheat system, it is expected that efficiencies would be greater than 55 percent. The fuels inherently have very low nitrogen oxide and carbon monoxide concentrations, so pollutant emissions are greatly reduced.

Hydrogen

Hydrogen appears to be an extremely attractive fuel for the future. It can be made from plentiful, renewable resources such as sunlight and water, and it produces only water vapor and small amounts of nitrogen oxides when burned. Hydrogen's flexibility in form and function make it usable to meet any energy need—from combustion devices to fuel-cell electricity producers. But, the hydrogen concept still presents three challenges to the energy research and development community:

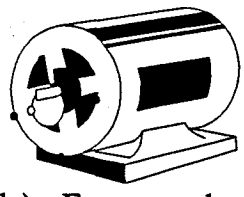
- Development of renewable production technologies that are economical and capable of industrial-level production.

- Development of storage techniques that are competitive with conventional fuels in terms of weight and volume.

- Broad introduction into a vital energy sector-preferably transportation (Melody, 1993).

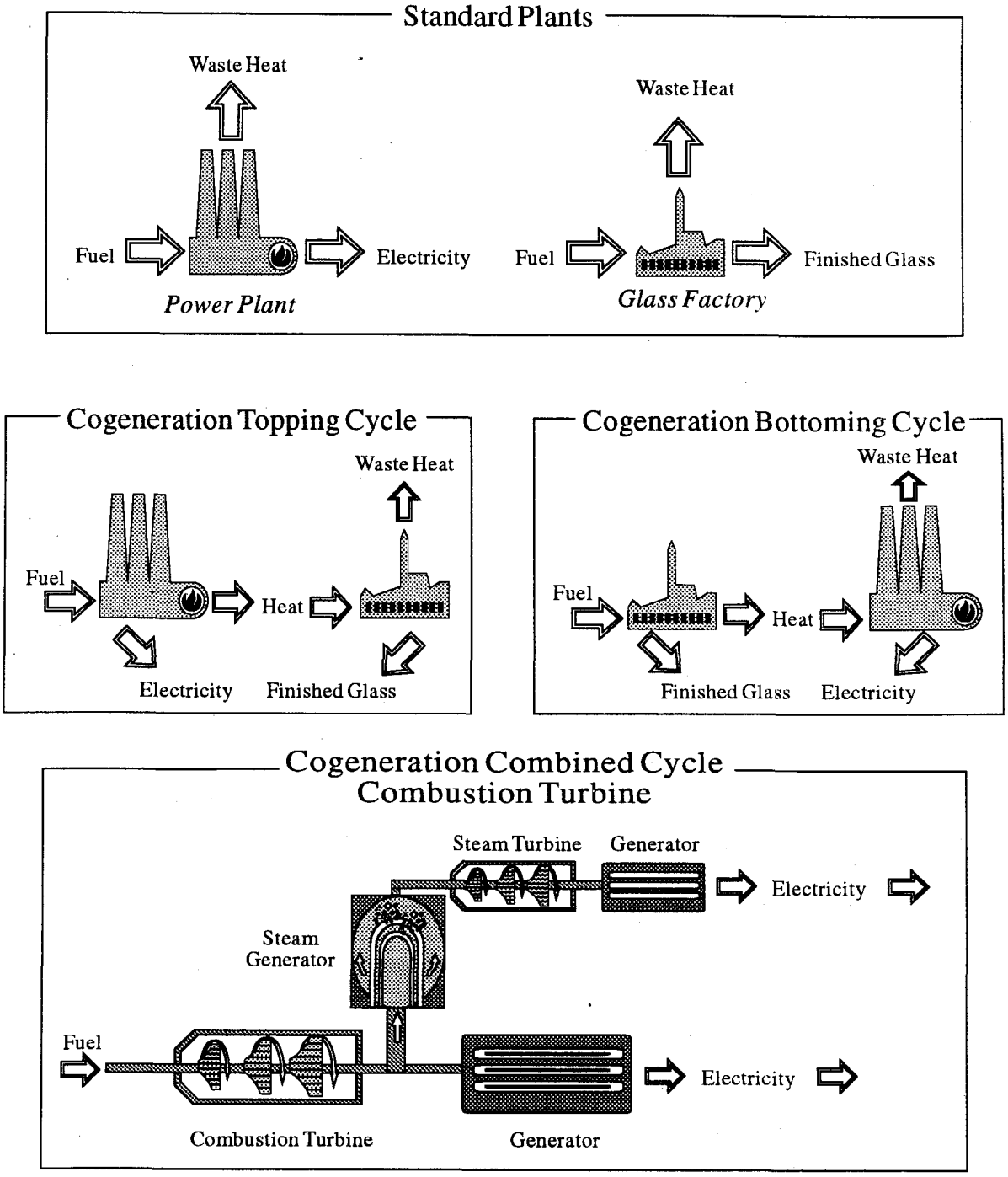
Hydrogen gas can be produced from biomass by electrolyzing water using electricity from photovoltaics, solar thermal collectors, or wind generators. The hydrogen could then be used in place of natural gas to power cars, homes, offices, and factories.

Cogeneration



Cogeneration facilities are not a method of energy conversion, but rather a method of energy efficiency. Industrial applications of cogeneration facilities typically take one of two forms. They use the heat left over from the process of generating electricity for another purpose (called a topping cycle). For example,

Figure 4-9: Cogeneration Processes



Source: Crawford, Multari, & Starr, 1994

the excess heat left over from running a steam turbine could be used directly to manufacture glass. The second basic principle uses the heat left over from an industrial process, such as food processing, to generate electricity (called a bottoming cycle). Figure 4-9 diagrams the various cogeneration processes.

Sometimes both a topping and bottoming cycle can be sequentially combined (called a combined cycle) in an electricity generation facility. Waste heat from the primary generation process is sent through a second turbine to create additional electricity. Such facilities are most economical and efficient when the fuel source is one that would otherwise be wasted, such as gas captured from sewage treatment facilities.

There are three cogeneration facilities in San Luis Obispo County (see Figure 4-10). San Luis Obispo's California Polytechnic State University power plant is a cogeneration facility with a capacity of .35 MW. A converted diesel engine burns natural gas to drive a generator for electricity. Heat from the engine's exhaust system is channeled to a steam boiler and used for dormitory space heating and hot water heating (topping cycle). In Nipomo, Koch California Ltd. owns another cogeneration facility that can generate up to .30 MW. Koch uses a natural gas-powered generator to produce electricity which it then sells to PG&E as a Qualifying Facility. The cooling water is then used to heat greenhouses (topping cycle).

The third biomass cogeneration facility is owned and operated by the city of San Luis Obispo at the Water Reclamation Facility. The facility uses an anaerobic digester to create methane gas from sewage. The methane gas is then burned to generate electricity for the facility. The waste heat from the electricity generation is used to keep the anaerobic digester warm (Marks, personal communication). This is an exemplary use of a cogeneration facility, as it uses waste products for fuel.

The enhanced oil recovery operations in the county are also considered cogeneration facilities. The wells in the Price Canyon Oil Field are equipped with enhanced oil recovery systems. Enhanced oil recovery methods boost production levels by burning gas (sometimes associated gas) to create steam. The steam is then injected back into the well. The heat from the steam lowers the viscosity of the heavy crude so it will flow more easily. Because of the large energy use required to create the steam (which can be very expensive) and the limited increase in production levels, enhanced oil recovery is used on a limited basis (only when gas and oil prices make it profitable).

Facility Siting

The basic idea behind cogeneration facilities—shared energy use—means that such facilities are best located at the point which can use the waste heat, the electricity, or both. Large institutions, agriculture sites and enhanced oil recovery sites have the most potential in San Luis Obispo County. Because cogeneration facilities are most often added on to existing operations, the type and extent of potential impacts are dependent on the individual project and are not easily generalized.

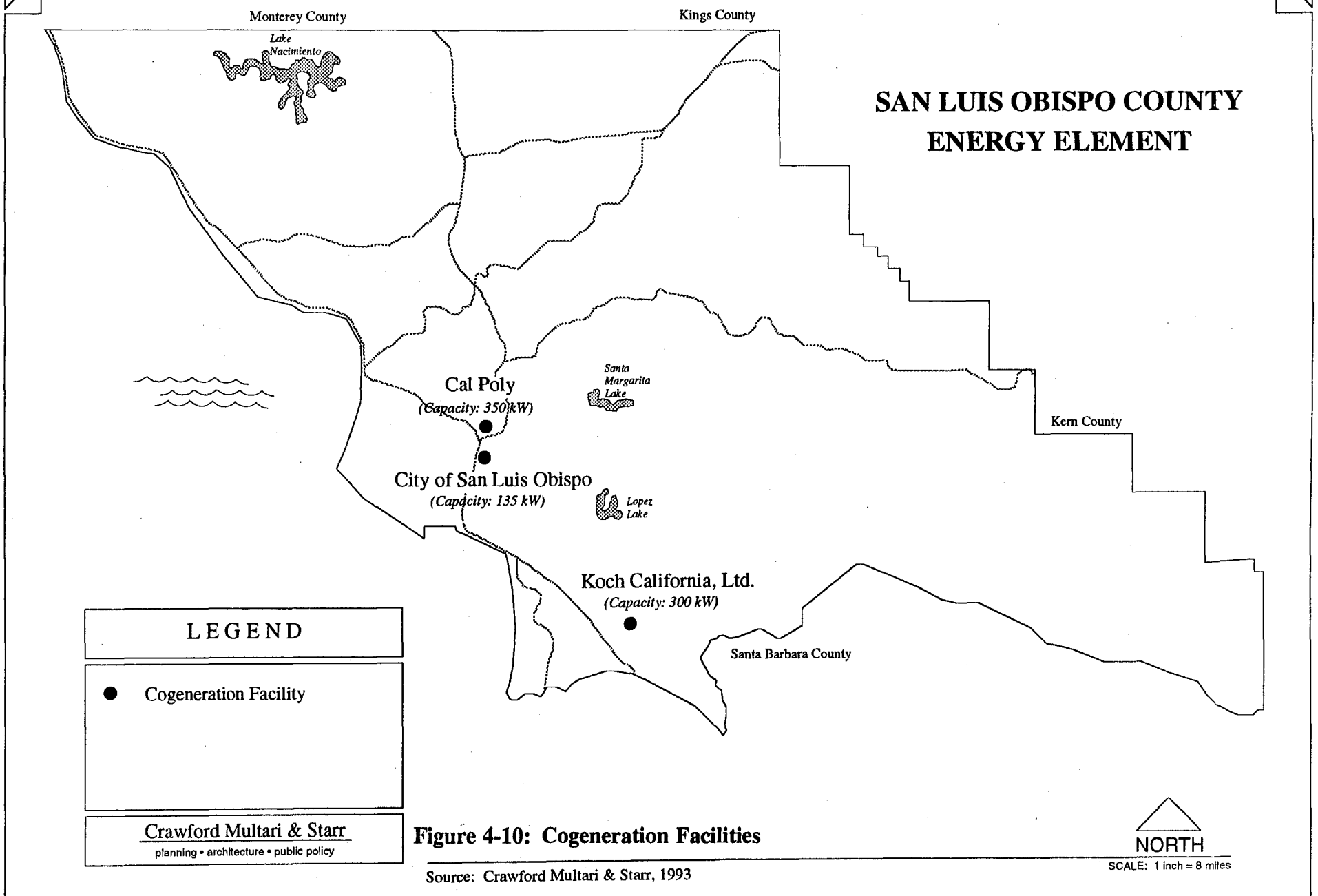


Figure 4-10: Cogeneration Facilities

Source: Crawford Multari & Starr, 1993

However, in almost all cases, the facility will need to be tied into the utility grid to store or transmit electricity; therefore, the same types of impacts associated with transmission lines may occur. But, in many cases, cogeneration facilities can be installed with few new impacts beyond those associated with the original land use. Cogeneration facilities that are designed as an integral part of a new industrial plant or operation can also be designed to have no significant impacts beyond those normally associated with the industrial operation itself.

Most proposals for cogeneration facilities will probably generate less than 50 MW in San Luis Obispo County, and will therefore require no special state or federal permits.[7] This means that the county will have the authority to permit all aspects of such facilities. In most cases, installation of cogeneration components at existing industrial, agricultural, or power generation facilities are generally categorically exempt from CEQA processing. This provides the county the opportunity to encourage cogeneration facilities by simplifying the review process.

XI. Goal: Address Major Energy Facility Siting Issues

Policy 44. Carefully monitor the federal government's progress in establishing a national repository for high level nuclear waste and the state's efforts for low level nuclear waste disposal. The county should advocate the safest methods of transportation and storage of nuclear waste.

> **Program 44.1.** Funding sources should be pursued to establish a program which monitors the progress and develops positions regarding the safe transportation and storage of nuclear waste.
>
> **Program 44.2.** A fiscal impact assessment or cost-benefit analysis should be conducted to provide accurate fiscal information to decision makers.

XII. Goal: Encourage Development of Cogeneration Facilities

Policy 45. Encourage cogeneration facilities as a method of reducing overall energy use. Energy will be used more efficiently because both electricity and as process heat are produced.

Policy 46. In cases where a cogeneration facility does not meet the criteria for an exemption from an environmental determination, review the project both for environmental and fiscal impacts of development.

> **Guideline 46.1.** Cogeneration facility development shall be subject to the general performance standards specified for energy facilities under Policy 29. If proposed in

[7] The California Energy Commission has authority for certifying thermal power plants greater than 50 MW capacity.

conjunction with an energy production facility, the facility must meet the requirements specified in the *Energy Element.*

Guideline 46.2. Cogeneration facilities should be built and operated in conjunction with existing facilities whenever possible.

Guideline 46.3. The risk of public exposure to hazardous materials should be minimized by using the least hazardous materials feasible, engineering safety systems, and state-of-the-art safety management practices.

Guideline 46.4. The cogeneration project will not change performance standards regarding air pollution, noise, traffic, or other possible nuisances to nearby property owners.

Guideline 46.5. The proposed facility shall comply with emission standards for harmful air pollutants, as determined by the Air Pollution Control District and the California Energy Commission, when appropriate.

Guideline 46.6. The applicant shall demonstrate that sufficient buffers exist to protect the housing units on adjacent properties from all hazards.

Distributed or Small-scale Utility

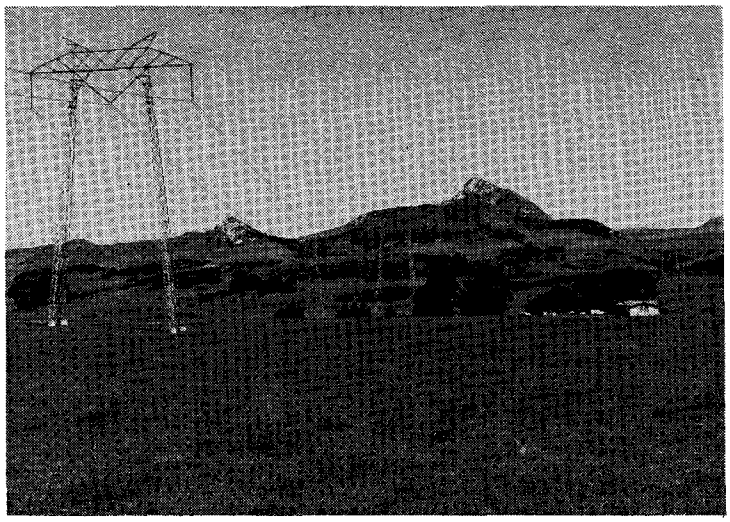
The concept of a *distributed utility* is a departure from building large scale, centralized power plants and extensive transmission lines to deliver electricity. The idea is to have more, smaller power generating and storage facilities that are located near the end users. These types of facilities produce electricity closer to where it is needed, thereby deferring or avoiding the need for new or upgraded transmission and distribution lines.

XIII. Goal: Encourage Development of Distributed Facilities

Policy 47. Distributed utility facilities should be encouraged because they may significantly increase the efficiency of the power system and may increase the use of local renewable fuel sources. They may also reduce environmental impacts and increase the economic well being of the county.

Policy 48. Encourage the development of small-scale power generating facilities which have substantially fewer environmental, social, and economic impacts. Such facilities could provide energy for local use, assist in the development of a more distributed utility, and may include solar, wind, biomass, and other renewable energy technologies.

Electric Transmission Lines



Electric power lines require right-of-way easements to cross over privately owned lands. Such ease-ments are negoti-ated directly between project proponents and land owners. Although shorter routes are generally pre-ferable from an environmental, engineering, and economic perspective, regulated utilities take other issues into consideration when selecting power li-ne routes. These issues include geology, terrain, surrounding land uses, aesthetics, local policies, public roads, private access roads, owner's uses and concerns, and service to the public. Electric power lines should be located near energy loads in order to maintain system reliability and minimize drops in electric voltage which occur over extended sections of distribution lines.

Underground installation of transmission lines is technologically possible, but the excavation required for underground lines and associated transition stations may result in significant environmental impacts. Easement widths for underground transmission lines are generally larger and greater land use restrictions may be necessary for underground lines to ensure access when necessary.

Transition stations (typically half an acre) are required where underground lines connect to overhead lines to provide for safe transmission of the power between the lines. To date, most transmission and distribution lines are placed above-ground because it is significantly less expensive.

Substations include equipment that switches, changes, or regulates voltage in the electric transmission and distribution system. Located at major junctions throughout a utility system, they can increase (step-up) the voltage at which power is transmitted, or substations can decrease (step-down) voltage near load centers such as communities or large customers.

There are seven electrical transmission line corridors within San Luis Obispo County. The corridors and originating power plants are shown on Figure 4-11. Four of the lines transport electricity generated from the Morro Bay Power Plant. Two other transmission line corridors originate at the Diablo Canyon Power Plant. The remaining transmission line corridor originates in San Joaquin Valley and enters the Carrizo Plains near Soda Lake.

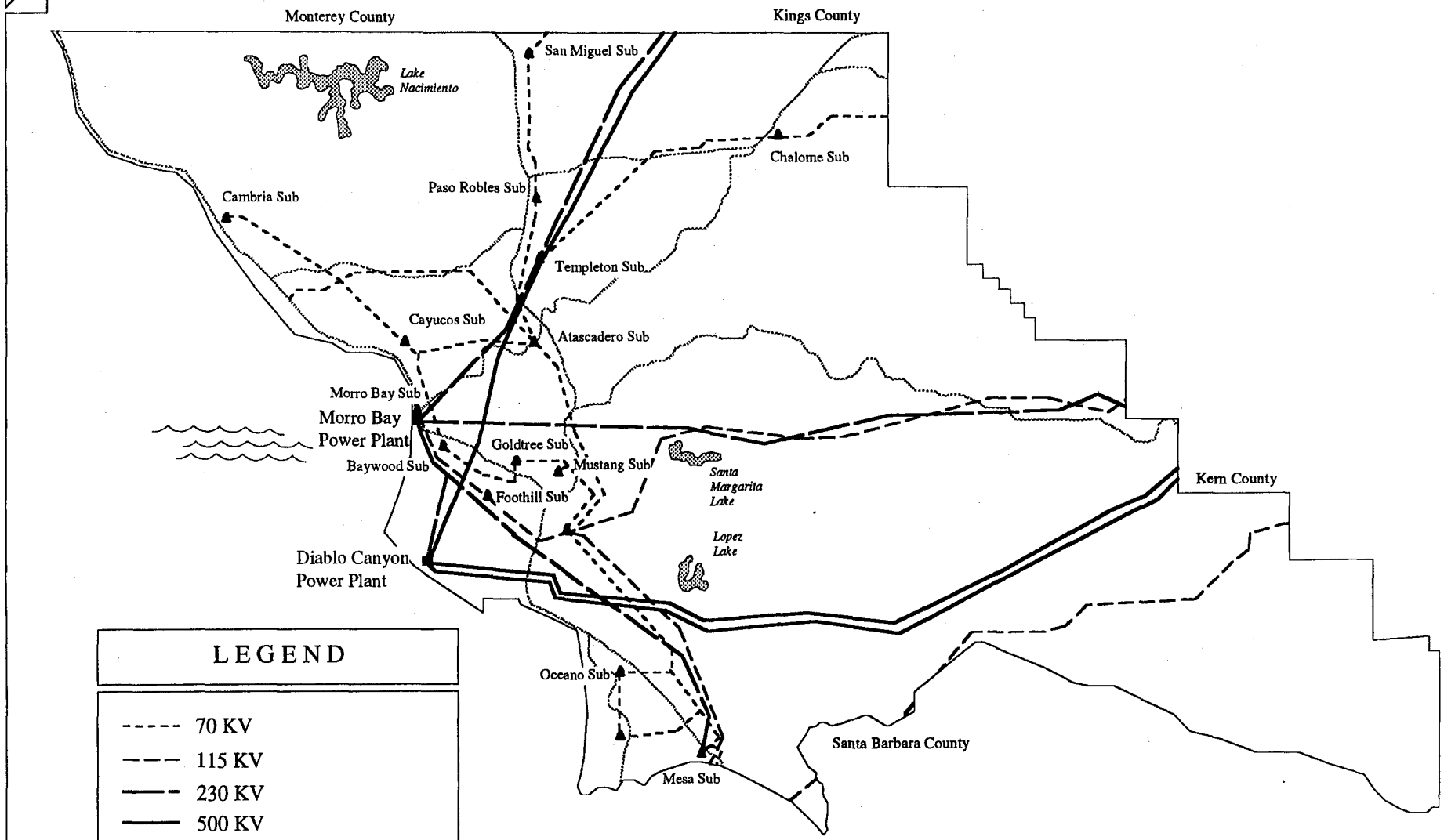
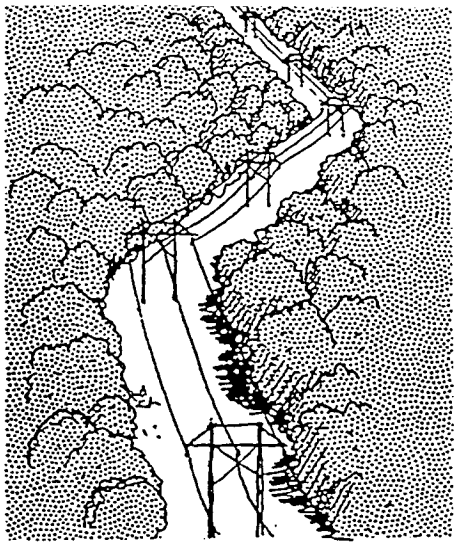


Figure 4-11: Transmission Lines

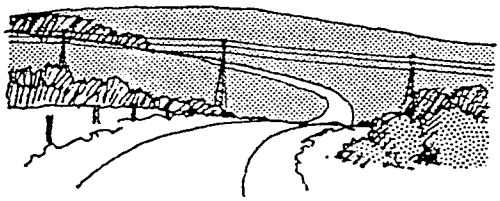
Source: California Energy Commission, 1982

Power lines cause significant visual impacts. Property owners may feel that such lines and towers decrease real property values. Power lines may also interfere with agricultural operations by preventing or creating hazards for aerial spraying. Additionally, agricultural production on land beneath power lines can be reduced if towers and poles interfere with the operation or maneuverability of farm cultivation equipment. However, the type of power line and towers used near agricultural areas can mitigate some of the impacts of new power line construction (see Figure 4-12).

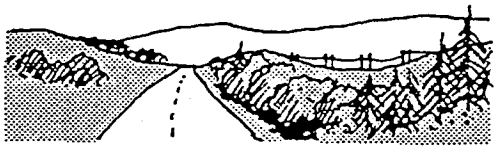
Figure 4-12: Transmission Line Placement



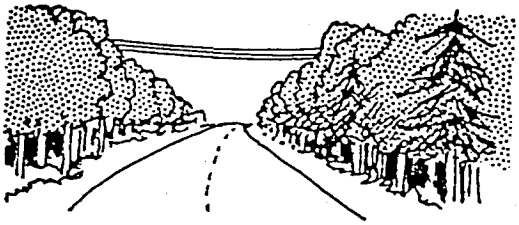
Selectively thinning the vegetation within the ROW creates a more natural appearance. Occasionally deflecting the ROW within wooded areas reduces the tunnel effect.



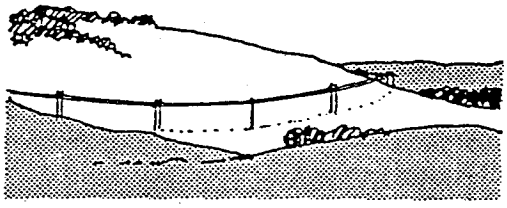
To avoid silhouetted towers, lines should be placed below ridgelines not at ridgelines.



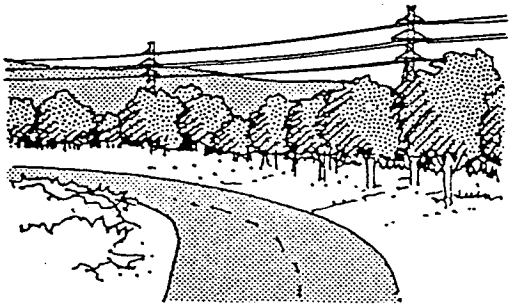
Placing lines behind forest cover and at roadway dips reduces their visibility.



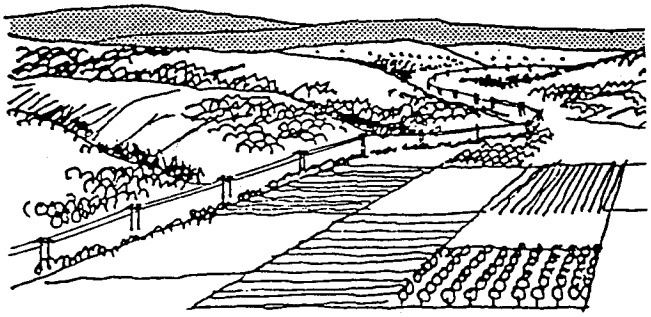
Preserving the forest edge at road crossings avoids long vistas down right of ways.



Lines should be aligned with the direction of natural contours.



Along roadsides, towers and wires should be sited so they can be absorbed by background vegetation.



Lines should be routed along valley edges and not down valley centers. Lines should be sited at the edges between different land uses to minimize disruption of the landscape. Lines should follow the grid in agricultural areas and the natural contours in hillside areas.

Source: Sedway Cooke Associates, *Colusa County Transmission Line Element, 1991.*

XIV. Goal: Protect Environmental and Visual Resources

Policy 49. Proposals for new transmission lines shall be evaluated for alternatives that significantly reduce their visibility and impacts to sensitive environmental resources.

Policy 50. As part of the siting analysis, proposals for new corridors should consider the following preferences to minimize impacts:

- First preference shall be for projects that upgrade or modify existing lines to meet increased demand. In such instances, the existing right-of-way should be maintained at its present width wherever possible.

- Second preference is for corridor consolidation with existing transmission lines, unless there are cumulative impacts that outweigh the benefits of consolidation. In such instances, the amount of additional right-of-way width to be acquired should be kept to the minimum area feasible for operation of the lines.

- The least preferred option is for transmission line projects that require entirely new corridors. In this instance, consideration shall first be given to using existing utility rights-of-way, including pipelines, railroads, and communication cables.

Policy 51. Existing access roads should be used wherever possible to avoid unnecessary disturbance of vegetation. If new roads are constructed, existing contours should be followed to minimize ground disturbance. New roads shall be constructed in a way that minimizes vegetation removal. A restoration plan shall be included as part of the application to restore the area to pre-construction conditions as much as possible. The following guidelines or equivalent alternatives should be considered by the review authority for all transmission lines:

Aesthetics

Guideline 51.1. Where new lines are constructed parallel to existing lines, the new towers should be sited as close as possible to the existing towers. Staggered patterns where new towers are placed mid-way between existing towers on the parallel line should be avoided.

Guideline 51.2. Where existing towers are upgraded, careful evaluation shall be made of the height and design of the new structures to determine the extent to which they increase the line's visibility.

Guideline 51.3. Where parallel towers are proposed for construction beside existing towers, careful consideration shall be given to the potential for cumulative visual impacts. If the cumulative impacts of adding the new lines are serious, or if the existing line already causes significant visual impacts, it may be preferable to site the additional line

on a new corridor away from the immediate vicinity, but not at the expense of biological resources.

Guideline 51.4. Where landscape conditions permit, and consistent with applicable safety standards, lines should be sited so that they are hidden behind topography and vegetation when viewed from major public roads or other critical viewing areas.

Guideline 51.5. New lines should not be sited along ridgetops that are visible from public roads designated critical viewing areas in the general plan.

Guideline 51.6. When lines are proposed for hillsides, they shall be located as low on the slope as possible to minimize the area from which they can be seen.

Guideline 51.7. When transmission lines must cross ridgetops, the alignments shall be routed so that the crossings occur at low points where skylining can be minimized.

Guideline 51.8. When forested areas must be crossed, tree removal shall be minimized by application of selected cutting. Cleared areas should emulate naturally occurring conditions.

Guideline 51.9. Alignments should be offset at road crossings, to minimize long views down corridors. Towers should be sited as far from the road as possible, while still meeting the California Public Utilities Commission safety requirements and National Electric Safety Code standards for electric field strengths beneath the mid span of the conductors.

Guideline 51.10. Natural tree cover should be retained to block views down the right-of-way. In flat, open areas, planting of groups of native vegetation in, and adjacent to, the right-of-way should be considered to screen views of towers, conductors, and the right-of way.

Construction

Guideline 51.11. Drainage facilities at transmission line construction sites must be designed to handle concentrated runoff, dissipate runoff, and prevent sediments form entering stream beds.

Guideline 51.12. To avoid roads up steep grades, helicopters, or other road-less construction techniques should be used to construct towers, string conductors, and perform maintenance activities in areas of extreme slopes and erosion hazards. Road-less construction techniques must also be used in areas where access road construction could create significant negative environmental impacts.

Guideline 51.13. Major earth-moving activities must be completed during the dry season unless there are other environmental constraints which require winter construction.

Guideline 51.14. Disturbed areas must be seeded/revegetated and fertilized, where appropriate, prior to winter rains.

Guideline 51.15. Ground disturbance in areas of unstable slopes should be avoided. Existing access in such areas should be used wherever possible.

Guideline 51.16. Provisions to contain runoff are required for all construction which could impact surface water sources. During construction, water quality will be monitored at runoff points to determine the presence of potentially harmful chemicals; provisions to correct harmful conditions should be made if harmful chemicals are detected.

Guideline 51.17. Ensure that appropriate fire-fighting equipment is available to all construction sites.

Guideline 51.18. Vehicles used to construct and maintain transmission lines must be equipped with spark arresters to minimize vehicle-induced fire hazards.

Guideline 51.19. Vegetation cleared from the right-of-way during the construction process must be disposed of in a safe and appropriate manner.

Guideline 51.20. Refueling of construction vehicles under the energized portions of the line is prohibited.

Guideline 51.21. Construction areas and roads shall be clearly designated, and all vehicles will be restricted to these areas.

Guideline 51.22. During construction, a qualified botanist shall be available on-site to monitor construction activities in areas which potentially contain rare, threatened, and endangered plants.

Guideline 51.23. Avoid using heavy equipment in all sensitive areas such as creek bottoms, vernal pools, wetlands, and riparian zones. Construction activities in sensitive areas must be supervised by personnel trained in wildlife and habitat protection consistent with the county approved mitigation monitoring program.

Guideline 51.24. Raptor nests should not be disturbed by construction activities during nesting season.

Guideline 51.25. Seasonal constraints on construction activity associated with wildlife habitat impacts must be followed, as specified by the appropriate state or federal regulatory agencies.

Guideline 51.26. Transmission line construction in cropland areas should be coordinated with local planting, irrigation, and harvesting schedules. Consideration should be given

to soil preparation requirements for crops such as alfalfa, carrots and permanent crops such as grapes, apples, almonds, and avocadoes.

Guideline 51.27. Disruption to existing land uses shall be minimized. In pasture areas, work sites should be fenced during construction to prevent access by livestock.

Guideline 51.28. Upon completion of construction activities, all construction materials, debris, and spoils should be removed from the work site. Site remediation may require the cleaning or inspection of equipment to prevent the dissemination of noxious weeds. Refer proposals to the Agricultural Commissioners office for a weed evaluation. In pasture areas, work sites should be dragged with magnets to locate and remove metallic debris which might otherwise be ingested by grazing livestock.

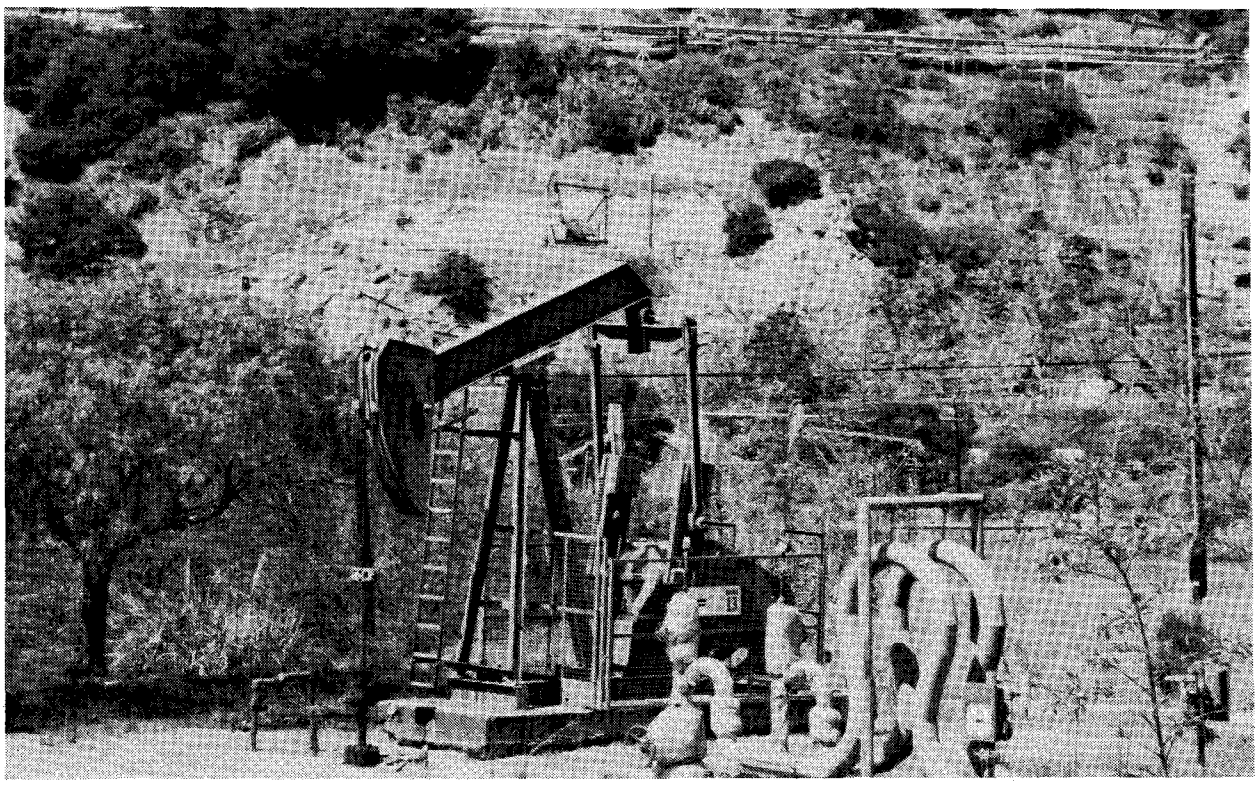
Guideline 51.29. Landowners should be consulted at the earliest possible time regarding a right of way being considered for a transmission line.

Guideline 51.30. Qualified personnel in paleontological, archaeological, ethnographic, and historical resources must be provided by the project developer to monitor construction in areas of known sensitivity. In compliance with an approved mitigation monitoring program, supervisory construction personnel should be provided with instruction on how to protect cultural resources.

Guideline 51.31. Combustion emissions from construction equipment should be minimized to the maximum extent feasible. NOx emissions from diesel generators and heavy-duty construction equipment can be reduced by installation of high pressure injectors, retarding the injection by installing high pressure injectors, retarding the injection timing by 2 degrees, and using reformulated diesel fuel.

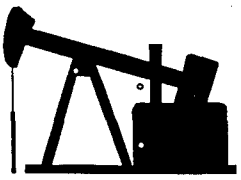
Guideline 51.32. Effective PM10 mitigation measures should be employed to minimize the amount of windblown dust.

CHAPTER 5: FOSSIL FUEL PRODUCTION



This chapter discusses fossil fuel facilities in the county, including oil and gas wells, separators, and refineries. Although some natural gas is pumped from local wells, this product is generally treated and transported with the crude oil resources. Existing gas and oil fields are shown on Figure 5-1.

Oil and Gas Wells Production and Processing



Surface exploratory methods bring in equipment for a short time, complete the exploratory drilling , and then remove the equipment. Therefore, most exploratory methods do not have a permanent impact on the change in land use. However, exploration methods can have significant, short-term impacts.

Permanent well sites are constructed by installing a pipe (called casing) in the well, and then pouring concrete between the casing and the well wall. If the oil or gas zone has sufficient pressure to be produced without pumping, a series of valves, attached to the tubing and casing will regulate the rate of oil or gas flow.

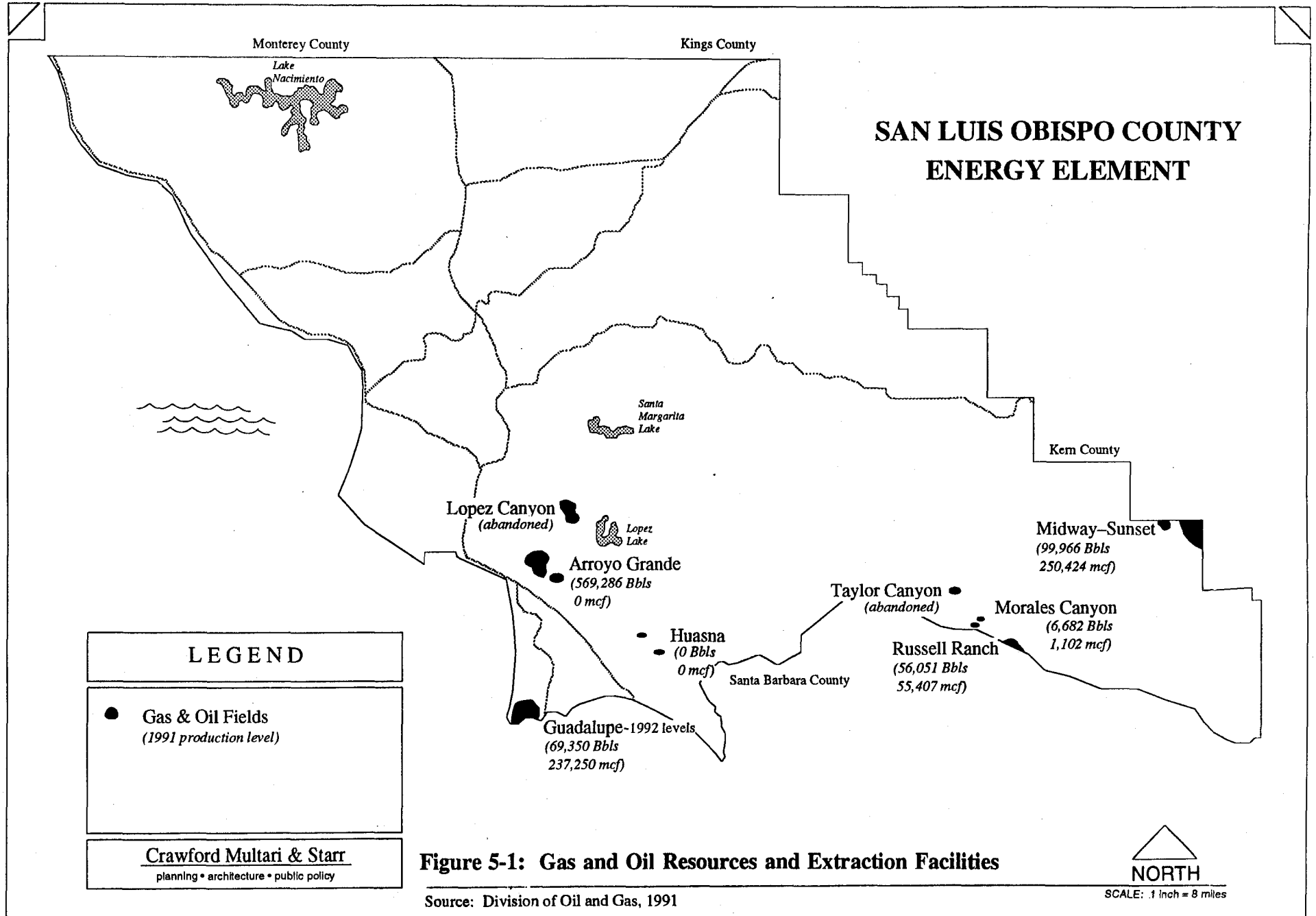
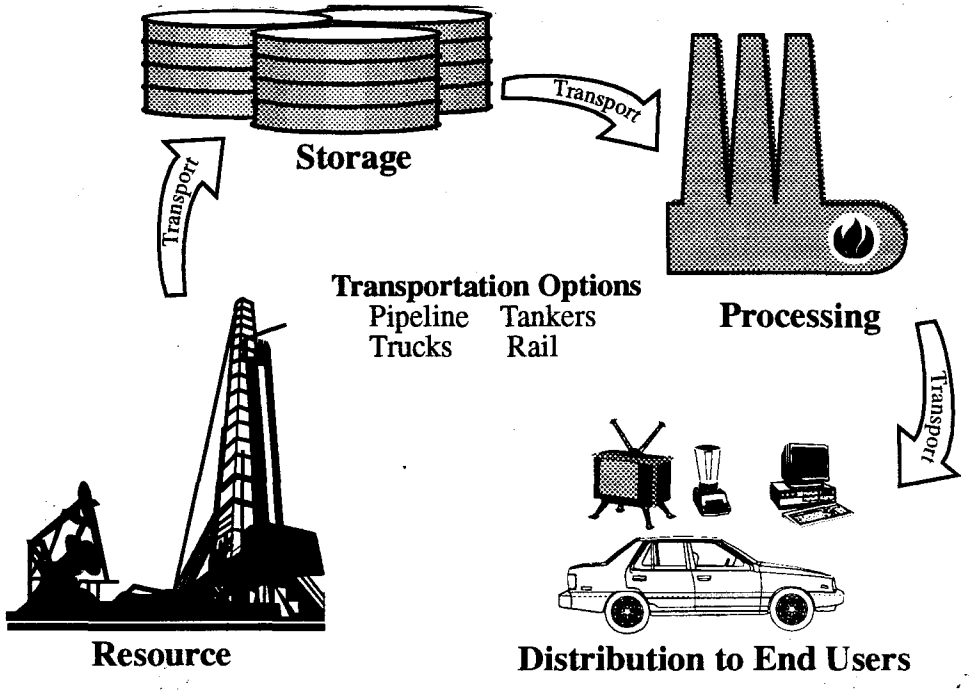


Figure 5-1: Gas and Oil Resources and Extraction Facilities

Source: Division of Oil and Gas, 1991

As gas and oil are extracted, conditions change within the oil reservoir and production levels generally start to decline. Enhanced oil recovery methods boost production levels by using pressure, heat, and/or chemicals. The most common enhanced oil recovery method used in California is to inject steam into the wells. The heat from the steam lowers the viscosity of the heavy crude so it will flow more easily.

Figure 5-2: Oil and Gas Development Cycle



A method of drilling that can minimize the impacts of production wells is called horizontal or extended reach drilling. Oil and gas reservoirs can be tapped by a bore hole that travels horizontally through the geologic formation instead of straight down. This can lead to fewer production wells being sited to produce the oil and gas. This technology has been proposed to produce oil and gas from both inland reservoirs and those located in nearshore coastal waters, from onshore production sites.

Once oil reaches the surface, it is pumped to a facility near the well that separates the oil, gas, and water. After separation, the crude oil is stored in nearby stock tanks and the gas is routed into lines leading to a gas plant for further processing. The water is either filtered and used for steam injection or water flooding, or it is pumped into a disposal well. In the past, oil production sumps were typically depressions in the ground used to separate oil and water or store produced fluids. In San Luis Obispo County, tanks or a protected sump must be used. After the crude oil leaves the field separator, it is further dehydrated in order to reduce its water

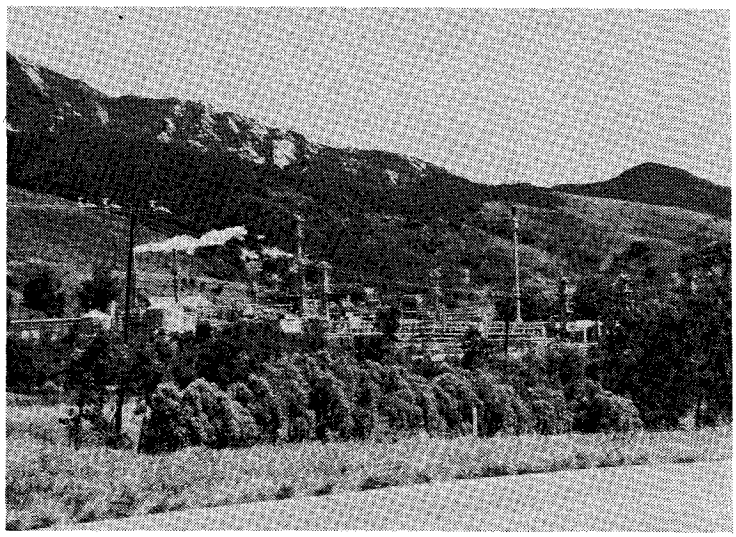
and sediment content to a maximum of one percent. The crude is then transported to refineries via truck, pipeline, or ocean tanker.

This topic is further discussed in the following section on transmission facilities. The refining process is usually accomplished by applying large amounts of heat to the crude oil. Crude oil, heavier gas liquids, or crude oil components are refined through a boiling or fractionating process that splits the product into liquids of different boiling ranges (or fractions) by distillations.

As the crude is boiled, those products with the lowest boiling rates are butanes (natural gas) which is generally sent to a gas processing plant for further refining. The second group of products to reach boiling point are called "light end" products and include gasoline and naphtha. (Light products, primarily gasoline, constitute more than 50 percent of the petroleum product consumed in California.) The next group of products to reach boiling point are distillates, such as kerosene, diesel, and jet fuel. (Distillates provide for about 30 percent of fossil fuel demand). The remaining substance are heavy products such as heavy gas oil and residual fuel, which can be used for asphalt and other specialties. Figure 5-2 summarizes the oil and gas development cycle.

Siting and Operation of Facilities

The potential for siting new oil and gas facilities in San Luis Obispo County raises serious environmental and political issues. In general, siting criteria should address land use, air quality, sensitive biological resources, geologic hazards, and hazardous materials management. Other equally important considerations are hydrology, noise, cultural resources, and emergency services, but these issues are specific to the proposed site and use (rather than a question of general location) and are best addressed during project level review.



Land Use Conflicts. One of the key land use issues related to siting of new or expanded facilities is compatibility of the facility with adjacent uses. Compatibility should consider nuisance factors, such as noise, dust, odor, traffic, light and glare, and potential impacts to visual resources and aesthetics.

One way to minimize land use conflicts is to consolidate facilities allowing all producers to share pipelines, processing facilities, and (to a lesser extent) marine terminals. The

facility owner must provide equal access and rates to all producers using the facility. It is even possible for producers to share a well field site or production and transportation equipment.

Air Quality. San Luis Obispo County is a non-attainment area for ozone and particulate matter, and the siting of new and/or expanded facilities must take potential emissions into account. Development of new or expanding existing facilities could result in both short-term and long-term increases in air emissions.

Sensitive Biological Resources. San Luis Obispo County spans 96 miles of coastline and has many areas with important habitat, recreational, and agricultural resources; those areas include the lands surrounding Nipomo Dunes, the north coast areas, and the Morro Bay watershed (San Luis Obispo County, 1992). Both the county's onshore and offshore biological resources could be affected by oil and gas exploration, construction, and production activities, especially oil spills. Any new or expanded support facilities should be sited to avoid biologically sensitive areas.

Geologic Hazards. Geologic hazards in the county that could impact energy facilities include earthquakes, landslides, subsidence, erosion, and soil expansion. In general, facilities should be sited at least 200 feet away from active or potentially active faults and should avoid slopes of 20 percent or greater. Site-specific geotechnical studies and specially designed building foundations can be used to mitigate potential impacts associated with subsidence and expansive soils.

Hazardous Materials Management. Hazardous materials are used, stored, and/or produced by the petroleum industry. The local health department monitors the hazardous materials used and stored throughout the county. The *Fossil Fuel Issues Working Paper* provides a list of federal and state regulations applicable to fossil fuel facilities in San Luis Obispo County.

Refinery Operations

Unocal has expressed interest in expanding their Santa Maria Refinery (see Figure 5-3) capacity to handle additional outer continental shelf production from Santa Barbara County. Recent improvements and modifications have increased the operational life of the facility. Additionally, if offshore or onshore production increases in or near San Luis Obispo County, the crude is likely to be sent to the Santa Maria Refinery. If the facility were expanded, hazardous materials handled at the facility could increase, additional tanker trips could be generated, and additional emissions could further degrade the air quality.

Because of the proximity of residential development, Unocal refinery operations and air emissions are a highly visible and publicized problem. However, there is no practical way to deal with the issue of residential proximity (aside from improving plant emissions and safety) because relocating the facility or establishing a new one is probably infeasible.

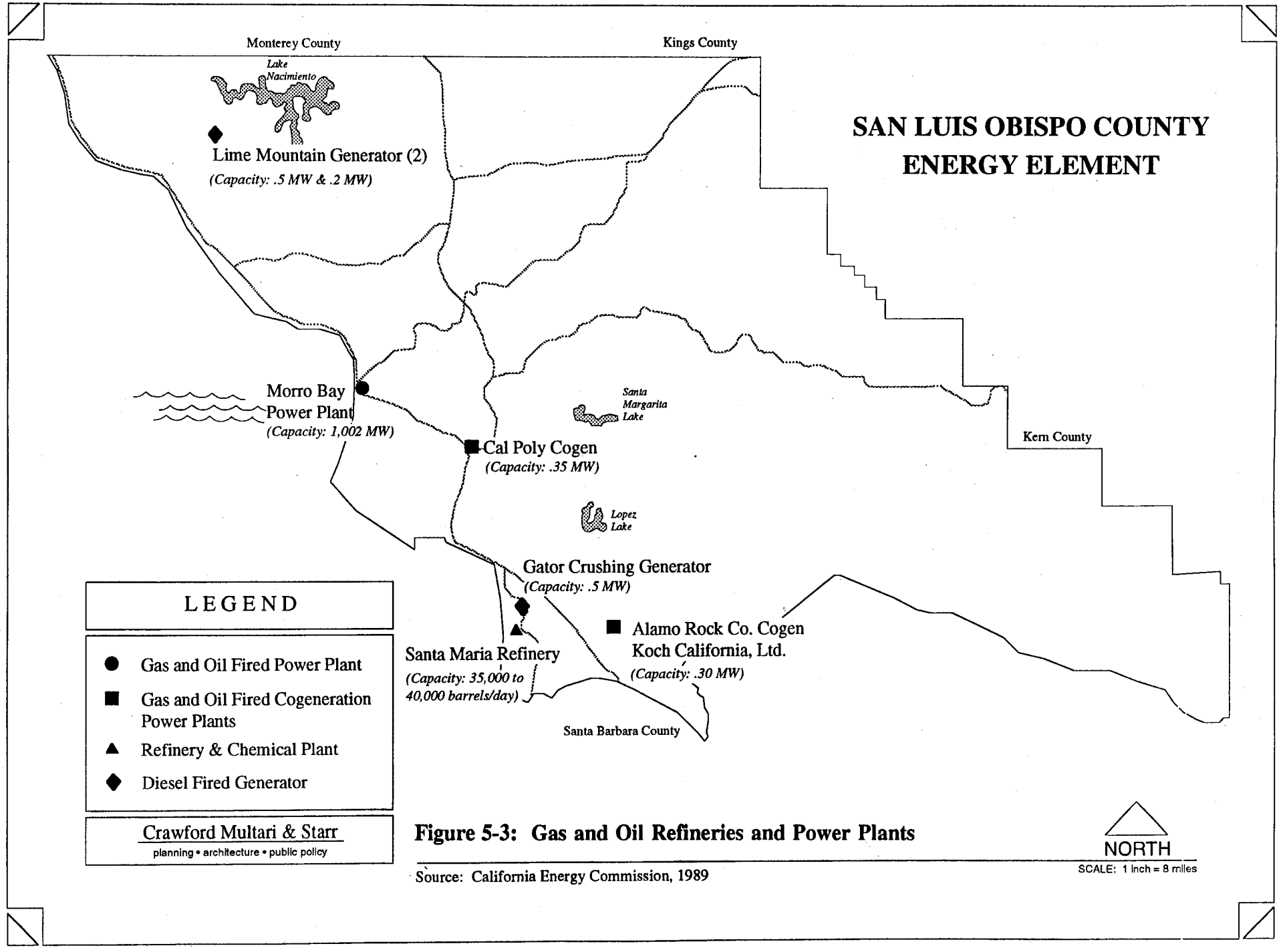


Figure 5-3: Gas and Oil Refineries and Power Plants

Source: California Energy Commission, 1989

Abandonment

San Luis Obispo County has numerous oil-related facilities, including storage facilities, oil pipelines, pump stations, and oil fields that are no longer in service, and other existing facilities will continue to be phased out, such as processing facilities and marine terminals. Older sites may have unsafe structures or concentrations of hazardous products on-site. Most permits prior to 1960 did not set forth proper and timely abandonment requirements at the termination of the operation. For new facilities, an abandonment plan should be considered as part of the application. The issue of abandoning and decommissioning facilities should be studied further. Future policy development should be based on an understanding of the various issues involved in abandoning facilities and coordination with other agencies.

Transporting Petroleum Products

Oil that has been produced (extracted from the ground) must then be transported to a refinery. The transportation options for petroleum products are either pipelines or marine terminals and tankers. Oil spills from tankers and marine vessels represent a sewage risk and significant harm to the marine environment; tanker accidents, tanker operations, and other vessel operations account for 45 percent of the total input of petroleum hydrocarbons going into the California marine environment (CCC, 1993). It should be noted that in 1993, the U.S. Navy was responsible for 82 of the 177 (46%) spill incidents in California (OSPR). Spills are most devastating when they leak directly into the marine environment. Oil spills can also occur as slow pipeline leaks into soils and groundwater.

Marine Terminals and Tankers

Marine terminals are used to load and/or unload crude oil or refined products onto, or off of, tankers. A terminal is made up of various components, including onshore tankage, pumping machinery, a network of pipelines and hoses, mooring systems, and oil spill response materials.

There are four marine terminals in San Luis Obispo County. Millions of barrels of petroleum materials are transferred through these facilities each year. At Estero Bay there are three operating marine terminals. Chevron operates two terminals to load crude and product, and the U.S. Navy has a terminal that was used to unload product. The Navy marine terminal is

currently out of service, but could still be used. PG&E has a terminal to unload fuel for the Morro Bay power plant. Unocal has a terminal at Port San Luis.

Unocal Avila Marine Terminal and Tank Farm. The Avila marine terminal is located in the San Luis Bay within the jurisdiction of the Port San Luis Harbor District and is owned and operated by the Unocal. The tank farm and pump station are located on the bluff south and above Avila Beach. The tank farm includes 15 above ground storage tanks, capable of storing over 2 million barrels of petroleum materials. The pump station includes a pump and a boiler house which shelter machinery used to pump and heat the petroleum materials as they pass through the pipelines.

San Joaquin Valley crude oil and partially refined products such as gas and fuel oil are loaded onto tankers. In the past, tankers have unloaded unleaded gasolines and diesel fuel. The gasoline was stored at the tank farm and distributed by tanker trucks to county stations. Tanker shipments of gasoline and diesel were stopped by Unocal in January, 1995. The tank farm is fully operational. Some of the storage tanks can only be partially filled due to oil spill containment measures being implemented. The pier and marine terminal are fully operational as is the pump station.

Pacific Gas and Electric Marine Terminal and Tank Farm. The Pacific Gas and Electric Company (PG&E) marine terminal was used to transfer fuel oil used as back-up fuel for the Morro Bay Power Plant. That facility is being phased out of use. Natural gas is used as the plant's primary fuel source. The power plant is located in the City of Morro Bay. The storage tanks are located at two sites, one in Morro Bay and the other in the county.

The marine terminal consists of a five point spread mooring system, undersea pipeline and hose, onshore pipeline, ten above ground storage tanks (on-site and off-site), pumps to move the fuel to the power plant, and heating equipment associated with the storage tanks.

Six on-site tanks are located next to the Morro Bay Power Plant within the City of Morro Bay's jurisdiction. They have a capacity of just over 800,000 barrels. Four off-site storage tanks are located approximately 3.5 miles northeast of the power plant in the jurisdiction of the county. They have a capacity of just over one million barrels. The tanks have heating systems which are used to keep the fuel oil at the appropriate temperature for use at the power plant.

United States Navy Marine Terminal and Tank Farm. The United States Navy marine terminal was used to transfer jet fuel from tankers, to shore and on to Lemore Naval Base in the San Joaquin Valley. The facility was decommissioned in 1991 and is currently out of service.

The Navy facility consists of an undersea pipeline and hose, onshore pumps and machinery, two above ground tanks and a pipeline which moves inland to Lemore Naval

Air Base. The tanks and pumping equipment are located in the City of Morro Bay, just east of a residential area. The tanks can store over 200,000 barrels of petroleum materials, in this case jet fuel.

Chevron Estero Bay Marine Terminal and Tank Farm. The Estero Bay marine terminal and tank farm are owned and operated by Chevron U.S.A. Built in 1929, the terminal handles crude oil received by pipeline from San Joaquin Valley and San Ardo oil fields. Tankers also unload cutter stock (blending agent to make crude oil less viscous) which is sent via pipeline to the San Ardo Oil field. The oil is shipped to refineries along the West Coast.

The terminal is composed of several distinct sections. Two separate mooring berths are located in approximately 50 feet of water. Berth 1 is an offshore mooring consisting of a five point mooring buoy tie-up approximately 3,000 feet offshore. Berth 2 is also an offshore mooring with seven point mooring buoy approximately 3,200 feet offshore.

The shore plant part of the facility contains the control house and apparatus which control the oil transfer operations. Also included in the shore plant area are various process tanks and ballast water recovery facilities.

The above ground storage tanks located on the hills above the terminal constitute the cargo storage area and have a capacity of approximately two million barrels. The tankage is located on hill ridges in order to provide a high elevation for gravity loading to vessels in the mooring berths.

The continued operation, or expansion, of existing marine terminals presents an ongoing risk of an oil spill. Typically, the oil industry prefers to transport oil by tanker because of the high construction cost of building new pipelines and greater flexibility in the final destination of the oil. However, in San Luis Obispo County, it is possible that tankering occurs where existing pipeline capacity is available. The county currently has no mechanism to ensure that tankering only occurs when all the onshore pipelines are at capacity. In addition because the marine terminals were established many years ago, the county has no mechanism to ensure that tankering activities incorporate the Best Available Control Technologies and the most effective mitigation measures.

Pipelines

Although pipelines pose less risk of spills than tankers, there are still significant impacts associated with pipeline development. The serious affects of a spill can be minimized by automatically shutting down the pipeline system, then promptly repairing the damage and cleaning up the spill. If this is done quickly, the spill should not reach underground aquifers or affect large amounts of surface water. The transportation of heavy crude oil is less hazardous to underground water supplies because the oil's viscosity inhibits it from soaking into the ground as quickly. Some of the most common causes of leaks are from pipe corrosion and accidental damage caused by excavating equipment.

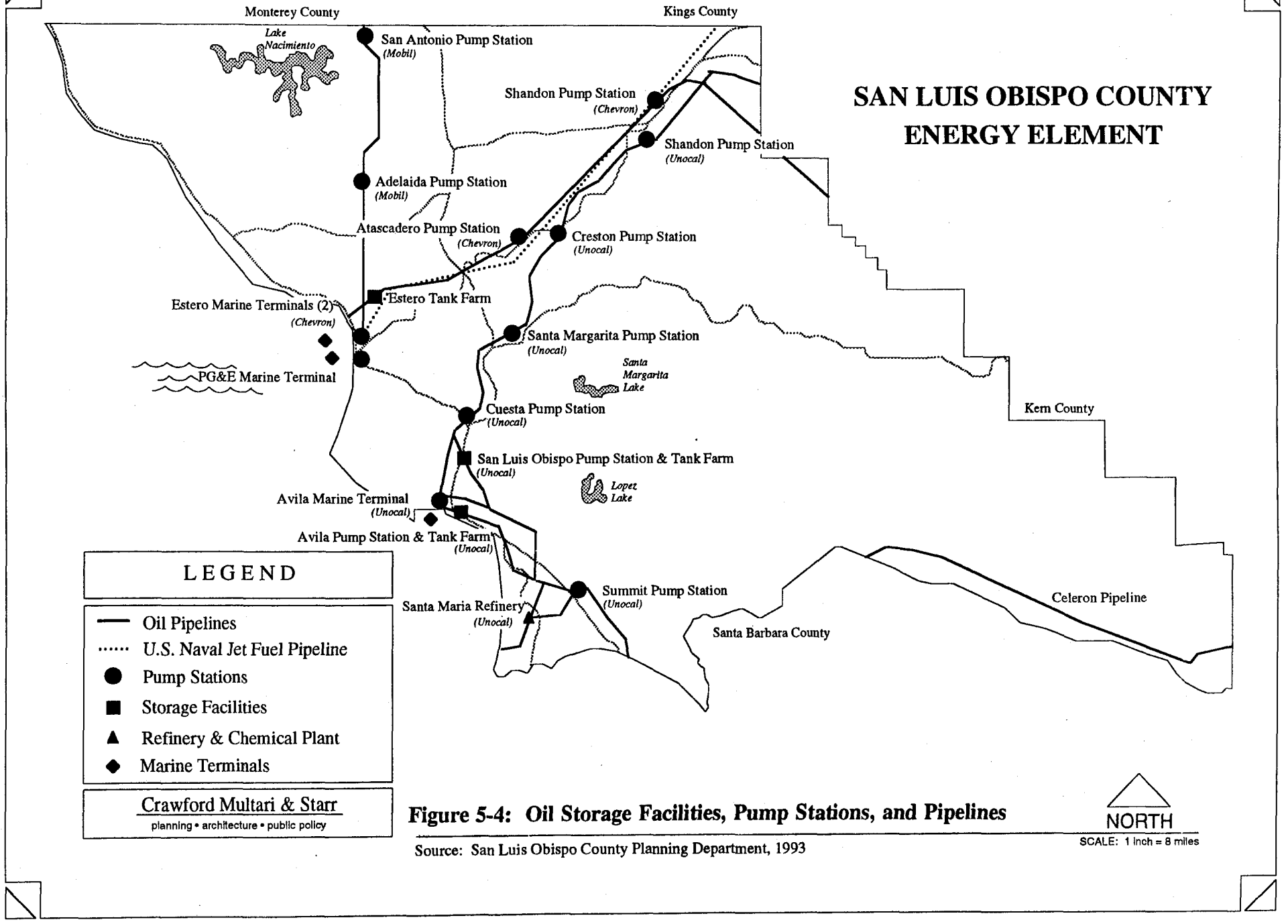


Figure 5-4: Oil Storage Facilities, Pump Stations, and Pipelines

Source: San Luis Obispo County Planning Department, 1993

The existing pipelines (as shown on Figure 5-4) create a transportation network that includes the following key links: 1) between onshore and offshore oil fields within San Luis Obispo and Northern Santa Barbara Counties to the Santa Maria Refinery on the Nipomo Mesa; 2) from the Santa Maria Refinery to the Avila Beach marine terminal and tank farm; 3) from the Santa Maria Refinery to San Joaquin Valley, where the crude is transported to San Francisco; and 4) from Kern and Monterey Counties to the Estero Bay marine terminal, where most of the crude oil is transported to Los Angeles or San Francisco processing plants. Each of these key systems is described below.

Chevron's Rio Bravo Pipeline System — Rio Bravo to Estero. Chevron owns a heated pipeline connecting its Rio Bravo system with its Estero Bay marine terminal. Chevron's Rio Bravo Pipeline system was constructed in 1929 to transport Kernridge heavy crude from the western region of Kern County to their Estero Bay marine terminal.

Some crude oil can be temporarily stored at the Shandon pump station, but most of it is stored at Estero Bay until loaded aboard tankers and transported to Chevron's El Segundo or San Francisco processing plants. In the past, tankers have transported crude from Estero Bay to Avila Beach. Approximately 4,300 feet of sections are scheduled to be replaced at various points along the pipeline in the near future.

The Shandon pump station was constructed in 1929 as part of a pipeline system extending from Kettleman City to Chevron's Estero marine terminal. The Shandon station has above ground storage tanks with a total capacity of 41,560 barrels. The Shandon station is still operating and pumps oil along the pipeline.

The Atascadero pump station was constructed in 1935, completing the Rio Bravo Pipeline system. The Atascadero facility is currently out of service with many of the parts being used as replacement at other stations. The Atascadero station is no longer needed because surfactant additives allow the crude oil to flow with less resistance, thus decreasing the need for a pump station.

Unocal Pipeline System. Unocal pipelines run to the Santa Maria Refinery on the Nipomo Mesa from the Guadalupe Beach oil field and through the Sisquoc connection in Northern Santa Barbara County. From the refinery they run to the Avila Beach marine terminal and tank farm, and continue through San Luis Obispo into the San Joaquin Valley. In addition, a natural gas pipeline system transports gas from the county to the Unocal Battles facility in Santa Maria where the finished product is sent into the gas distribution network.

The pipeline system includes several storage facilities and pump stations along the route. The storage facilities are located at Guadalupe oil field, the Santa Maria Refinery, Avila marine terminal, San Luis Obispo tank farm, Santa Margarita, Creston, and Shandon. Pump stations located in the county include Summit in the south county, Avila marine terminal, San Luis Obispo, at the base of the Cuesta Grade, Santa Margarita, Creston, and Shandon.

Mobil Oil Pipeline — San Ardo to Estero. Mobil operates two pipelines which run south from the San Ardo oil field in Monterey County to the Estero Bay marine terminal. The 12-inch line is used to transport crude oil from the field for shipment by tanker to Los Angeles or San Francisco. A 4-inch line is used to transport cutter stock to the San Ardo field from Estero Bay. Cutter stock is a partially refined petroleum product that is used as blending agent to make crude oil less viscous and more free flowing.

The terrain of the pipeline right of way is hilly and rugged with limited access in some spots. The pipelines run along the ridge line of the inland hills west of Paso Robles. The system includes two pump stations, the San Antonio pump station on Oro Fino Canyon Road and the Adelaida pump station east of Vineyard Drive and south of Dover Road.

Celeron — All American Pipeline. Celeron Corporation in Houston, Texas owns and operates the All American Pipeline (AAPL). The AAPL extends from Santa Barbara County to refining facilities in Texas. The line originates in Las Flores Canyon, Santa Barbara, runs north to Gaviota and on to Sisquoc in Santa Maria, where Unocal recently constructed a pipeline connecting to their Santa Maria refinery. The All American Pipeline continues north to San Luis Obispo and heads east to Kern County. It travels parallel to the county line, with 37 miles of the line located in San Luis Obispo County. There are no pump stations or storage tanks sited in San Luis Obispo County associated with the pipeline.

United States Navy Jet Fuel Pipeline. This pipeline is currently out of service, having been decommissioned in 1992; it could be reactivated if leased or purchased by a private operator. The right of way generally follows Chevron's pipeline to the northeast portion of the county. No pump stations or above ground storage tanks exist in the county along the pipeline.

Storage Facilities

A tank farm is a grouping of above ground storage tanks strategically placed for temporarily storing crude oil and refined or partially refined petroleum products. In the above facility descriptions tank farms are discussed as a part of a marine terminal or pump stations. Several other tank farms in the county are associated with oil fields or pipelines.

The San Luis Obispo tank farm is located adjacent to the City of San Luis Obispo and includes a pump station and seven storage tanks that are currently empty. The tanks could be used, but Unocal has no present or expected need for them. In recent years, various tanks have been dismantled, and there are plans to dismantle two more tanks within the next year or so (F. Nichols, personal communication). Unocal, under the direction of the California Regional Water Quality Control Board — Central Coast Region, is implementing a remediation project in this area for petroleum materials spilled over the years.

Storage facilities should complete a risk assessment which evaluates the hazard footprint (area around the facility that may be affected by a explosive, toxic, or harmful release). By identifying the potential extent of such an incident, appropriate buffers can be recommended.

Natural Gas

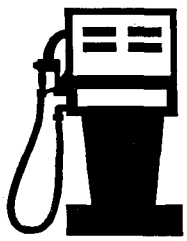
The Southern California Gas Company's natural gas pipeline system serves most of the communities in the county. A significant portion of the rural population depend on propane service from San Luis Butane, Suburban Propane, Petrolane, Northern Energy, and Central Coast Propane. Pacific Gas and Electric brings gas through a 20-inch pipeline from Kettleman to run the Morro Power plant. The pipeline network is shown on Figure 5-5.

Southern California Gas Company. The Southern California Gas Company provides natural gas service to San Luis Obispo County. Transmission lines enter the county from the south and continue north, providing gas to the communities of Nipomo, Oceano, Arroyo Grande, Grover Beach, Pismo Beach, Shell Beach, and Avila Beach. The transmission lines branch off in Arroyo Grande; one line goes to the coast towards Pismo Beach and another line moves north to the City of San Luis Obispo. Near the airport the line branches off again this time west to Los Osos and Morro Bay. From this line a branch runs to Camp San Luis and Cuesta College.

A main transmission line moves along Highway 1, through Morro Bay, Cayucos, and ending in Cambria. At Toro Creek Road, a pipeline line heads east following Highway 41 up to Atascadero. Another line comes up from the San Luis Obispo following Highway 101. That line serves Santa Margarita, Garden Farms, and south Atascadero. It then continues north to Paso Robles, bringing gas to Templeton along the way. A line then runs west and connects with a Mobil gas line which serves the San Ardo oil field in Monterey County. A line runs northeast from Atascadero to parts of Creston and Shandon.

Pacific Gas and Electric. A 20-inch pipeline runs from the northeast portion of the county to the Morro Bay Power Plant. Along the way it serves some residents in Shandon. This pipeline originally provided gas to the Unocal pump station at Shandon, but Unocal now uses its own pipeline to supply gas.

Gasoline and Diesel



The county gasoline and diesel supply is shipped in by either tanker or truck. (The only refinery in the county, Santa Maria Refinery, does not produce gasoline or diesel.) The gasoline and diesel sold in the county is distributed by truck shipments from refineries in Kern and Los Angeles Counties. Tanker shipments delivered to Unocal's Avila Beach tank farm occurred until 1995 when they were discontinued due to industry economics.

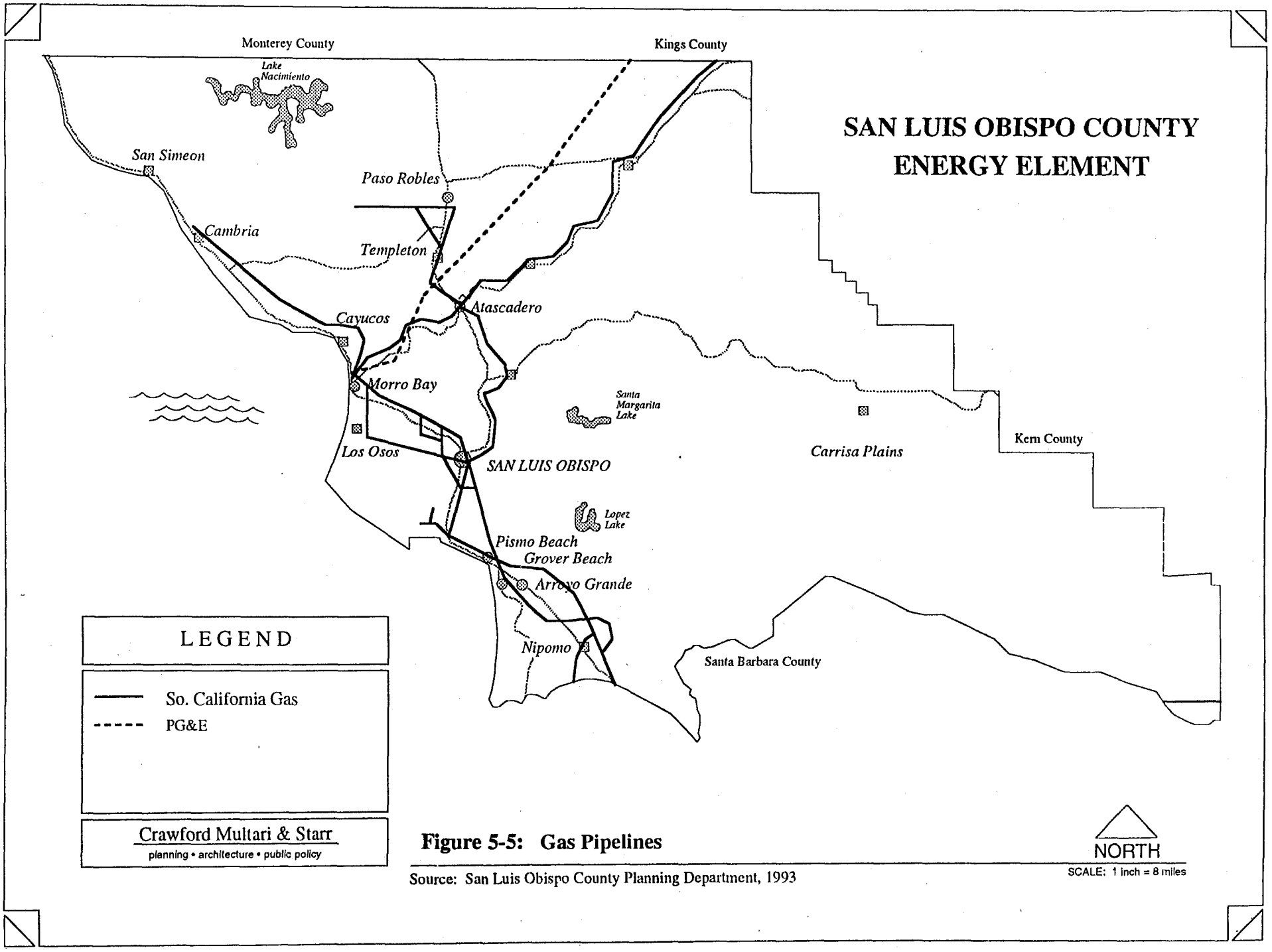


Figure 5-5: Gas Pipelines

Source: San Luis Obispo County Planning Department, 1993

The San Luis Obispo County Environmental Health Department and the City of San Luis Obispo Fire Department maintain records on all the underground fuel tanks. Their records show a total of 225 fueling stations (181 are in unincorporated areas of the county). The fueling stations are primarily retail gasoline and diesel enterprises (132). There are also 54 fueling areas for government or public use, such as hospitals, postal service, road maintenance, school districts, etc. Another 39 fueling areas are for private business such as PG&E, trucking businesses, and construction companies, among others (M. McGee and S. Niles, personal communication).

Definition of Goals, Policies, Guidelines and Programs

The policies and guidelines in this document are intended to serve as an educational resource for projects that require only ministerial approval. For discretionary projects, projects that need a public hearing, the element provides guidance and a range of alternatives for achieving the stated goals.

The goals, policies, guidelines, and programs contained in the *Energy Element* provide the foundation for reviewing energy related projects for consistency with the general plan. They also provide guidance for incorporating energy conservation and efficiency measures into other development projects. The following definitions identify the differences between a goal, policy, guideline, and program:

Goal

Goals are a general expression of community values, an ideal future result, or condition, related to public health, safety, or general welfare. Goals provide the vision statement of *what* is desired in the future.

Policy

Policies are more specific than goals. Policies are statements that guide decision making. Policies are based on the information gathered and analyzed during the process of developing the element.

Guideline

Guidelines provide direction on *how* to implement the goals and policies contained in the general plan. While guidelines may provide specific direction for addressing a particular issue, alternative approaches that achieve the same result may also be used.

Program

Programs are actions that may be initiated by the county or other public agencies to achieve specific community objectives. Because programs are recommended actions rather than

mandatory requirements, county implementation should be based on consideration of community needs, support for the program, its related cost and available funding.

XV. Goal: Protect Public Health, Safety and the Environment

Policy 52. Proposed new or major additions to fossil fuel facilities must provide a sufficient buffer zone from existing or proposed human population, with special consideration given to those who cannot be quickly evacuated to safety, such as the disabled and elderly. To establish a buffer zone, a comprehensive risk analysis should be completed.

Policy 53. Encourage the upgrade or replacement of existing, older facilities to current safety and environmental standards. Further develop a cooperative working relationship with the oil and gas industry, including holding workshops to provide information about the permitting process and providing informational materials.

> **Program 53.1** Develop an inventory of all existing fossil fuel facilities in the county. The inventory should provide information related to; the age and condition of those facilities, current monitoring systems and programs, storage of hazardous chemicals, the potential of hydrocarbon release and risks to the surrounding environment and population, and the estimated schedule for proposed repairs, maintenance, upgrades or modifications.
>
> **Program 53.2** The issues of decommissioning, abandoning and site reclamation, should be studied and policies should be developed to address these concerns. The study should discuss the abandonment of pipelines, storage facilities, oil fields, pump stations, marine terminals, and other related facilities.
>
> **Guideline 53.3** Pipeline replacement projects should be expedited, providing the applicant submits adequate and timely information for review. It is recommended that pipeline replacement applications be submitted as soon as possible for processing to avoid unforeseen delays.

Policy 54. In an effort to decrease redundancies, coordinate with state and federal agencies to promote an information exchange about safety standards, regulations, and strategies to pursue in order to minimize the safety hazards from fossil fuel facilities.

> **Guideline 54.1.** Prior to beginning construction, (including grading), for any facility, the applicant shall obtain all required permits and approvals from the county Air Pollution Control District.

Guideline 54.2. Prior to the issuance of a land use permit, the applicant shall demonstrate that all phases of the proposed project will be in compliance with the county's *Clean Air Plan* and other related county regulations, and that appropriate mitigation will be implemented.

Policy 55. Encourage the establishment of a safety review committee consisting of qualified individuals from industry, local, state, and federal agencies for proposed major energy projects. The purpose of the group is to review all safety related issues associated with the operation of the facility, and to coordinate responses from enforcement and review agencies as well as the general public.

Guideline 55.1. A system safety review report shall be completed prior to approval of a proposed facility, or major addition to an existing facility. This report shall be completed by an objective third party, with all costs borne by the applicant. The report shall be reviewed by the safety review committee. The purpose is to evaluate the overall safety of the proposed facility and should include, but is not limited to; a review of past safety records, evaluation of current safety practices, analysis of maintenance and repair procedures and system testing procedures.

Guideline 55.2. Regular monitoring and inspection of facilities shall be documented to ensure compliance with standards established as part of conditions of approval or an environmental quality assurance program. Project related conditions of approval shall be conspicuously posted and available at all times.

Guideline 55.3. As part of the land use permit application, existing and proposed facilities should submit to the county monitoring and testing programs relevant to the project and the region being implemented, or proposed by the operator. The most recent test results for existing facilities shall also be submitted.

Guideline 55.4. For new pipeline systems, leak detection systems using the best available technology shall be required unless the operator can demonstrate that timely and effective leak detection can be reliably achieved through other methods or measures. Pipelines shall be constructed so that *smart pigs* or other appropriate technologies which evaluate the internal condition of the line can be accommodated.

Policy 56. Encourage existing and proposed facilities to focus on measures and procedures that prevent oil, gas, and other toxic releases into the environment. This policy is to ensure that facilities; 1) take measures to prevent releases and spills, 2) prepare for responding to a spill or release, and 3) provide for the protection of sensitive resources. A review of a facilities spill response plans, or reports from other agencies, should be completed to monitor compliance.

Policy 57. Require consolidation of facilities in any expansion or modification project, to the maximum extent technically, environmentally, and economically feasible. Commingled processing shall be required where appropriate, to avoid or reduce project and cumulative impacts.

Policy 58. When new sites are needed for industrial or energy-related development, expansion of facilities on existing sites (or on land adjacent to existing sites) shall take priority over opening up additional areas or the construction of new facilities. Exceptions will only be allowed when it can be shown that 1) alternative locations are infeasible and that the environmental impacts of opening up a new site are less than the impacts of expansion on or adjacent to existing sites; 2) to do otherwise would adversely affect the public welfare, and 3) adverse environmental impacts are mitigated to the maximum extent feasible. Adverse environmental impacts from the siting or expansion of existing industrial or energy developments shall be mitigated to the maximum extent feasible.

Guideline 58.1. An adequate source of water for use by the facility shall be identified in the project application. The application shall include information about the amount and source of water used by the facility. The types of activities the water will be used for shall also be described.

Guideline 58.2. Site specific surveys, including inventorying of rare plants, should be completed at the appropriate time of the year, as part of preliminary work for any proposed facility. Consideration shall be given to the various seasons of migratory or transitory species. Further study may be required as part of the environmental review process.

Guideline 58.3. Site specific measures should be proposed with the application to mitigate construction and long-term impacts on terrestrial biota. The applicant shall submit a restoration, erosion control, and revegetation plan that is consistent with the results of the environmental review process. The plan must be approved by the county planning department.

Guideline 58.4. To enhance a projects compatibility with surrounding areas, no direct beams of exterior lighting should be visible beyond the boundaries of the parcel. Low intensity, shielded, and highly efficient fixtures are preferred for outdoor lighting at a facility.

Guideline 58.5. Proposed facilities shall be screened or fenced from view to reduce visual impacts identified during the environmental review process. Requirements for screening are included in the land use ordinances.

Guideline 58.6. Facilities should be sited in swales or other natural depressions where appropriate and should not be profiled against horizons.

Guideline 58.7. Screen facilities from public view through height limitation, careful site design, artificial contoured banks and mounding, extensive landscaping, and decorative walls and fences.

Guideline 58.8. Any part of the facilities that cannot effectively be screened, shall be painted with non-reflective paint and with colors which blend with the surrounding natural landscape.

Policy 59. Construction of new processing facilities at consolidated sites will be considered only if determined that proposed facilities are not redundant. Operators and owners of sites shall make their facilities and property available for commingled processing and consolidation of oil and gas facilities on an equitable and non-discriminatory basis.

Policy 60. An application for a land use permit for a project including onshore extended reach facilities for the purpose of exploring or developing offshore oil or gas resources, may be approved only after a specific plan, as described in government code section 65450 et seq., for overall development of the parcel has been approved.

Guideline 60.1. Amend applicable ordinances to clarify that extended reach facilities shall also be subject to processing requirements as described in 23.08.094 for petroleum refining and related industries.

Policy 61. If extended reach facilities are proposed, surface disturbance should be minimized by consolidating the drilling facilities and using existing pipeline right-of-ways, where feasible, to their full extent before new sites are considered.

Policy 62. Consolidate new pipeline corridors within existing pipeline or electrical transmission corridors to the maximum extent technically and environmentally feasible.

Policy 63. If new pipelines are necessary, encourage common carrier or multiple-user pipeline construction and use.

Policy 64. State and federally approved oil spill contingency and countermeasure plans for proposed facilities shall be submitted to the county prior to the start up of operations. These plans shall at a minimum demonstrate that adequate containment exists to contain 110% of each tank's contents, unless otherwise required by applicable state and federal regulations.

Guideline 64.1. To reduce the possibility of injury to the public, facility employees, or the environment, the applicant shall submit an emergency response plan which details response procedures for incidents that may affect human health and safety or the environment. The plan shall be based on the results of the comprehensive risk analysis. In the case of a facility modification, the existing response plan shall be evaluated by the safety review committee and revisions made as recommended.

Guideline 64.2. Major new facilities shall be sited within five minutes response time of an adequately staffed and equipped fire/emergency response station. A fire protection system and response plan shall be approved by the governing authority.

Policy 65. In the event of a petroleum or hydrocarbon release, implement the following policies:

- Emergency response and initial clean up of the spill site shall be completed as soon as possible. An emergency permit shall be granted as appropriate. A state of emergency as defined in the general plan must exist for a permit to be granted.

- Environmental impacts caused by response and clean up activities shall be minimized. Environmental monitor(s) shall be on site to reduce possible impacts.

- A post-spill environmental assessment of the site shall be performed to evaluate and quantify the damage to resources.

- Remediation and restoration of the site to pre-spill conditions shall be completed. These activities are subject to the land use permit/environmental review process.

- If the site cannot be restored to its pre-spill condition, the responsible party shall contribute to an environmental enhancement fund to be used for on or off site mitigation projects.

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APPENDIX A: ENERGY TERMS

Energy Forms

Energy can be produced in a variety of forms: heat; motion; or chemical reactions. In each case, a physical system becomes capable of producing energy (and doing work) as a result of a change in the "state" of the system. For example, energy can be produced in a fossil fuel power plant by burning (changing the state) of oil or natural gas to generate heat, which is used to convert (or change the state of) water to steam. The heat energy in steam is then converted to mechanical energy when the steam is directed through a turbine, which turns a generator, which produces electricity.

Energy Measurement

Energy is measured in many ways; natural gas is usually measured in cubic feet and therms, gasoline is measured in gallons, and electricity is measured in watts. To simplify comparisons, all of energy sources can be converted into British thermal units (Btu). One Btu is the amount of thermal energy required to raise the temperature of one pound of water 1°F at sea level.

Some important Btu conversions are:

One kilowatt-hour of electricity = 3,412 Btu	One gallon of unleaded gasoline = 125,000 Btu
One cubic foot of natural gas = 1,000 Btu	One gallon of diesel fuel = 140,000 Btu

Conservation & Efficiency

The terms energy conservation and energy efficiency are used often in this document. Both result in the use of less energy. An example of *energy conservation* is turning down a thermostat to heat a home at 68 degrees rather than 72 degrees. A way of improving *energy efficiency* in the same home would be to keep the temperature at 72 degrees, but use less energy to maintain that temperature by installing wall insulation and a more efficient heating appliance. In the latter case, the energy service (or comfort level) would not change, but the method of achieving the service would be more efficient and use less energy.

APPENDIX B: ENERGY CONSUMPTION TABLES

Table B-1: Average Household Energy Consumption by Fuel Type
San Luis Obispo County 1990

Household Energy Use	Energy Use	Annual Cost ($)
Electricity Use (kWh/year) cost @ 11.5¢ per kWh	6,066	697.59
Gas Use (therms/year) cost @ 60¢ per therm	590	354.00
TOTAL YEARLY COST		$1,051.59

Energy Source	Energy Use (%)	Annual Cost ($)
Electricity Use		
Lighting	17	$118.59
Refrigerators and freezers	24	167.42
Space heating	9	62.78
Water heating	7	48.83
Space cooling	7	48.83
Appliances	19	132.54
Miscellaneous	17	118.59
TOTAL	100	$697.59
Natural Gas Use		
Space heating	46	$162.84
Cooking	6	21.24
Water heating	35	123.90
Other	13	46.02
TOTAL	100	$354.00

Source: Percentages taken from the California Energy Commission, *Energy Efficiency Report*, 1990, Table A-4. Household energy use for electricity is based on total energy sales in San Luis Obispo County for 1990 (487,018,000 kWh) divided by the number of occupied housing units in 1990 (80,281). Household energy use for gas is based on total energy sales (33,840,000 therms) divided by the number of households with gas (57,312).

Table B-2: Average Commercial Energy Consumption by Fuel Type
California 1987

Commercial Energy Use (for a 1,000 square foot space)	Energy Use	Annual Cost ($)
Electricity Use (kWh/year) cost @ 11¢ per kWh	7,433	817.63
Gas Use (therms/year) cost @ 43¢ per therm	231	138.60
TOTAL YEARLY COST		956.23

Energy Source	Energy Use (%)	Annual Cost ($)
Electricity Use		
Lighting	43	351.58
Refrigerators	11	89.94
HVAC	32	261.64
Other	14	114.47
TOTAL	100	$817.63
Natural Gas Use		
Water heating	10	13.86
HVAC	35	48.51
Cooking	6	8.32
Other	49	67.91
TOTAL	100	$138.60

Note: This assumes a rate of 12¢ per kWh for electricity. Commercial rates are actually much more complicated (based on time of use, use over an allotted baseline, peak demand, etc.). We feel 12¢ serves as a reasonable "average" rate. Source document uses 1987 data. More recent data is not available.

Source: California Energy Commission, 1990.

APPENDIX C: IMPLEMENTATION MEASURES

Summary of Implementation Measures

The following Table C shows how each of the policies and programs will be implemented by the county. The implementation table summarizes the responsible agency, the action or actions required, the expected benefits or impacts of the proposed policy or program, the potential funding source, and the time frame for initiating work on the proposed policy or program. The purpose of this table is to assist the county in implementing the policies, programs, and guidelines of the *Energy Element*.

Funding is an important consideration in implementing a general plan element. Which department(s) should be responsible for implementation, and given tight budget constraints, how will the implementation measures be funded?

Many of the policy and programs in the *Energy Element* recommend specific programs or studies to undertake. These programs will require additional departmental funding and may place additional demands on staff time. A few of the programs place the financial responsibility on the project developer. Others specify grant funding. The priority for completing these programs is listed in the last column of the table. The table uses the following abbreviations:

Short	Short term priority. Program should begin within one to three years.
Inter	Intermediate term priority. Program should begin within three to five years.
Long	Long term priority. Program should begin sometime after five years.

The policies that establish guidelines and standards to review potential energy projects will come into effect immediately upon adoption of the *Energy Element*. These items are listed as "on-going priorities."

The following acronyms are used in the table of implementation measures:

CIP	Capital Improvements Program
CEC	California Energy Commission
COG	Council of Governments
CPUC	California Public Utilities Commission
ISTEA	Inter-modal Surface Transportation Efficiency Act
LCP	Local Coastal Plan
EMF	Electric and Magnetic Fields
HVAC	Heating Venting and Air Conditioning
ROW	Right-of-Way
RTP	Regional Transportation Plan
RWQCB	Regional Water Quality Control Board
SLO	San Luis Obispo

Table C: Implementation Measures

Policies and Programs	Responsible Agency	Action Required	Expected Benefits	Funding Source	Priority
Policy 1. Encourage energy efficient land development.	Planning	Project review.	Less infrastructure and service costs to county. Less auto use.	Fees/Grants	On-going
Program 1.1. Review road standards.	Planning/ Engineering	Project review. Revise standards.	Less infrastructure costs to developer and county.	Grants/ General Fund	Inter
Program 1.2. Examine land use in existing residential areas.	Planning	Update LUE/LCP.	Less auto use. Improve air quality. Costs to update and publish revised documents.	Grants/ General Fund	Short
Policy 2. Encourage new residential development in higher density residential areas.	Planning	Project review.	Support pedestrian, bicycle, and transit use. Improve air quality.	Fees	On-going
Policy 3. Locate new commercial centers near major activity nodes and transportation corridors.	Planning	Project review.	Support pedestrian, bicycle, and transit use. Improve air quality.	Fees/ General Fund	On-going
Policy 4. Promote new commercial development that provides for immediate needs of the rural residents.	Planning	Project review.	Less auto use. Improve air quality. Increased services to residents.	Fees/ General Fund	On-going
Policy 5. Encourage new office development to locate near major transportation corridors.	Planning	Project review.	Support transit use. Improve air quality. Reduce vehicle miles traveled.	Fees/ General Fund	On-going
Program 5.1. Recommend that the COG establish a program to monitor the jobs-housing balance.	Planning/COG	Formal recommendation	Less auto use. Improve air quality.	Grants	Inter
Policy 6. Promote use of first floor space in downtown buildings for high-volume commercial uses.	Planning	Project review.	Support pedestrian, bicycle, and transit use.	Fees/ General Fund	On-going
Policy 7. Provide safe and convenient bicycle and pedestrian links.	Planning	Project review.	Support bicycle use. Improve air quality.	Fees/ General Fund	On-going
Policy 8. Encourage bicycle and pedestrian use.	Planning	Do Program 8.1	Support bicycle use. Improve air quality.	Fees/General Fund	On-going
Program 8.1. Update the *County Recreation Element*.	Planning	Review for consistency.	More bicycle use. Costs to update and publish revised documents. Improve air quality.	General Fund	Inter
Policy 9. Encourage the use of bicycles by applying for grants.	Parks and Recreation/Planning	Apply for grants and purchase items.	Facilities to support bicycle use. Additional construction costs.	State or federal grants	Inter
Policy 10. Install adequate bike racks and storage facilities (1:10 ratio).	Planning/COG/ General Services	Project review.	Facilities to support bicycle use. Increased bicycle use.	Private funds/ ISTEA/ General Fund	On-going
Policy 11. Encourage and facilitate the use of railways.	Planning/COG	Monitor and act as necessary.	Less fuel use to move goods and people. Improve air quality. Requires staff time.	General Fund	On-going
Policy 12. Encourage the state to increase funding for transit.	Planning/COG/State	Letter of Support.	Less gasoline use. Improve air quality.	General Fund	On-going

Policies and Programs	Responsible Agency	Action Required	Expected Benefits	Funding Source	Priority
Policy 13. Encourage the development of alternative fueling stations.	Planning/General Services	Project review.	Less gasoline use. Improve air quality.	General Fund/ ISTEA/Grants	Inter
Policy 14. Purchase alternative fuel vehicles as funding sources become available.	County and cities	Develop incentive program.	Less gasoline use. Improve air quality.	State or federal grants.	Short
Policy 15. Convert the county fleet to alternative fuel vehicles.	County Operations	Maintain current policies.	Less gasoline use. Improve air quality.	General Fund/ Grants	Long
Policy 16. Coordinate with local governments to develop multi-modal system.	County and cities/COG	Coordinate transportation plans.	Less fuel use. Improve air quality.	General Fund/ ISTEA	Long
Policy 17. Reduce the number of private vehicle trips.	County and cities/ Private Businesses	Do Program 17.1	Less fuel use. Improve air quality.	General Fund/ Grants	Inter
Program 17.1. Steps to promote telecommunications.	Planning/ General Services	Establish telecommunication center.	Less auto use. Improve air quality.	General Fund/ Grants	Inter
Policy 18. Maximize energy conservation and discuss potential energy impacts of a project.	Planning	Revise application requirements.	Increase energy efficiency of development projects.	General Fund/ Grants	Short
Program 18.1. Develop a voluntary rating system.	Planning	Develop rating system.	Increased energy efficiency. Less embodied energy in building materials.	General Fund/ Grants	Short
Program 18.2. Amend applicable ordinances to provide incentives.	Planning	Develop incentive program.	Increased energy efficiency. Less embodied energy in building materials.	General Fund/ Fees	Short
Program 18.3. Require that new multi-family residences and secondary residences have individual utility meters.	Planning	Modify ordinance.	Less residential energy use. Less water use.	General Fund/ Grants	Short
Program 18.4. Develop a program which requires energy efficiency remodels.	Planning	Develop program.	Less residential energy use.	Fees	Inter
Program 18.5. Require that all CEQA documents evaluate potential energy impacts of a project.	Planning	Amend ordinances.	Greater information to decision makers. Less wasteful use of energy. Increased energy efficiency.	General Fund/ Grants	On-going
Program 18.6. Amend or create applicable ordinances to protect solar access.	Planning	Amend ordinances.	Less energy use in buildings. Increased energy efficiency.	General Fund/ Grants	Inter
Program 18.7. Support special demonstration projects.	Planning	Project review.	Less energy use in buildings.	General Fund/ Grants	On-going
Policy 19. Design new residential units to provide for the most effective use of solar radiation for heating and ventilation at night for cooling.	Planning	Revise application requirements.	Less energy use in buildings, particularly HVAC. Increased energy efficiency.	General Fund/ Fees	On-going

Policies and Programs	Responsible Agency	Action Required	Expected Benefits	Funding Source	Priority
Policy 20. Preserve and care for existing trees along and in public streets.	General Services/ Planning	Schedule maintenance for existing trees. Develop species list.	Less energy use for HVAC. Increased energy efficiency.	General Fund/ Fees	On-going
Program 20.1. Develop a tree planting program that seeks to coordinate community resources to plant trees.	General Services/ Planning	Develop program.	Less energy use for HVAC. Increased energy efficiency.	Grants/ Volunteers	Inter
Policy 21. Continue cost effective efforts to become a model energy user.	All County Departments	Implement Programs 21.1 and 21.2.	Less overall energy use. Increased energy efficiency.	CEC/Utility Rebate Programs/ General Fund	On-going
Program 21.1. Develop an educational incentive program.	All County Departments	Develop incentive program.	Reduce cost of government. Cost of incentive offset by energy savings.	Grants/ Savings	Short
Program 21.2. Continue energy audits of county facilities.	General Services	Conduct audits.	Identify ways to reduce energy use.	CEC/ Local Utilities	On-going
Policy 22. Incorporate cost effective energy efficient design.	General Services	Incorporate modifications in CIP.	Less energy use in buildings. Increased energy efficiency.	CEC/ Local Utilities	Short
Policy 23. Encourage agricultural advisory groups to continue to promote energy conservation and efficiency measures to agriculturists.	Agriculture Commissioner/ Farm Bureau/ Ag Task Force	Maintain open dialogue.	Less energy use in agriculture. Increased energy efficiency.	General Fund/ Grants	On-going
Policy 24. Encourage development of local biomass and composting facilities.	Planning	Project review. Review existing ordinance.	Less solid waste to dispose. Less non-renewable fuel use.	General Fund/ Fees	On-going
Policy 25. Work with local utilities to maximize the use of conservation and efficiency programs.	Planning/ Local Utilities	Do Programs 25.1 and 25.2.	Less energy use in buildings. Increased energy efficiency.	General Fund/ Local Utilities/ Grants	Short
Program 25.1. Establish an energy information center.	Planning/ Local Utilities	Set up information center.	Increased energy awareness. Less energy use in buildings.	General Fund/ Local Utilities	Short
Program 25.2. Develop an information sheet on energy and water efficient design guidelines.	Planning/Building/ Local Utilities	Prepare information sheet.	Less energy use in buildings. Increased energy efficiency.	General Fund/ Local Utilities	Short
Policy 26. Seek grants to sponsor energy education programs.	Planning/COG/ APCD/Engineering	Seek grants. Develop programs.	Less overall energy use.	Grants/ Local Utilities	Short
Policy 27. Encourage source reduction and recycling of solid waste.	Engineering/Planning	Do Programs 27.1, 27.2, and 27.3.	Less energy use in manufacturing. Less solid waste to dispose.	General Fund/ Grants	On-going
Program 27.1. Research the feasibility for using recycled materials.	Engineering	Conduct study.	Less solid waste to dispose. Less embodies energy in paving materials.	General Fund/ Grants	Inter
Program 27.2. Develop a program to recycle construction and demolition materials.	Engineering/Building	Develop program.	Less solid waste. Less energy use in manufacturing.	General Fund/ Grants	Inter

Policies and Programs	Responsible Agency	Action Required	Expected Benefits	Funding Source	Priority
Program 27.3. Develop an environmental resource guide.	Planning/Engineering	Develop guide.	Increase use of recycled goods.	General Fund/ Grants	Inter
Policy 28. Preferences for meeting the electricity need of SLO County residents and businesses.	CPUC/CEC/Planning	Project review.	Less fossil fuel use. Increased renewable energy sources.	General Fund/Fees	On-going
Policy 29. Protect the public from potential hazards and significant environmental impacts.	Planning	Follow guidelines for project review.	Less environmental impact from transmission lines.	General Fund	On-going
Program 29.1. Provide measurements of electric and magnetic fields for transmission line ROW.	Planning	Amend ordinances.	More information on EMF fields.	General Fund/ Grants	Short
Program 29.2. Development standards near transmission lines.	Planning	Amend ordinances.	Reduce potential hazards from transmission lines.	General Fund/ Grants	Short
Policy 30. Proposed electricity facilities must provide a sufficient buffer zone.	Planning	Project review.	Reduce potential hazards from transmission lines.	General Fund/ Grants	On-going
Policy 31. Encourage the upgrade or replacement of existing, older facilities.	Planning	Project review. Coordination.	Reduce potential hazards from transmission lines.	General Fund/Fees	On-going
Policy 32. Coordinate with state and federal agencies.	Planning	Maintain open dialogue.	Reduce potential hazards from transmission lines. Enhanced permit processing.	General Fund	On-going
Policy 33. Minimize human exposure to potential transmission lines hazards.	Planning	Project review.	Reduce potential hazards from transmission lines.	General Fund	On-going
Policy 34. Monitor EMF research and policy developments.	Planning	Monitor research.	Reduce potential hazards from transmission lines.	General Fund/ Grants	Long
Policy 35. Consider EMF in planning for future electric facilities.	Planning	Project review.	Reduce potential hazards from transmission lines.	General Fund/ Fees	On-going
Policy 36. Address the issue of EMF when reviewing proposed land divisions.	Planning	Project review.	Reduce potential hazards from transmission lines.	General Fund/ Fees	On-going
Policy 37. Encourage the development of sustainable energy sources.	Planning	Project review.	Less fossil fuel use. Increased local economic development.	General Fund/ Fees	On-going
Policy 38. Encourage the use of photovoltaic power generating facilities.	Planning	Project review.	Less fossil fuel use. Increased local economic development.	General Fund/ Fees	On-going
Policy 39. Encourage commercial development of solar power systems.	Planning	Follow guidelines for project review.	Less fossil fuel use. Increase renewable energy sources. Increased local economic development.	General Fund/ Fees	On-going
Policy 40. Encourage waste-burning biomass facilities.	Planning/Engineering	Follow guidelines for project review.	Less solid waste to dispose. Increase energy efficiency. Possible air quality impacts.	Grants	On-going

Policies and Programs	Responsible Agency	Action Required	Expected Benefits	Funding Source	Priority
Policy 41. Encourage wind energy development.	Planning	Project review.	Increased energy efficiency and renewable energy sources. Increased local economic development.	Grants	On-going
Policy 42. Encourage development of mitigated hydroelectric facilities.	Planning/Engineering	Follow guidelines for project review.	Increased energy efficiency of electricity production.	Fees/Grants	On-going
Policy 43. Encourage the use of geothermal hot water.	Planning/RWQCB	Project review.	Increased energy efficiency.	General Fund	On-going
Policy 44. Monitor progress in establishing repository for high and low level nuclear waste.	Planning	Do Programs 44.1 and 44.2.	Less health risk from nuclear waste.	General Fund/ Grants	On-going
Program 44.1. Find funding to establish a monitoring program.	Planning	Establish program.	Less health risk from nuclear waste.	General Fund/ Others	Long
Program 44.2. Conduct fiscal impact assessment or cost-benefit analysis.	Planning	Conduct study.	Estimate of costs and benefits.	General Fund/ Grants	Long
Policy 45. Encourage cogeneration facilities.	Planning	Project review.	Increased energy efficiency of electricity production.	Fees/ General Fund	On-going
Policy 46. Environmental review of cogeneration facilities.	Planning	Project review.	Less environmental impacts.	Fees	On-going
Policy 47. Distributed utility facilities should be encouraged.	Planning	Project review.	Increased efficiency of electricity production and distribution.	General Fund/ Grants/Fees	On-going
Policy 48. Encourage the development of small-scale power generating facilities.	Planning	Project review.	Increased efficiency of electricity production and distribution.	Fees	On-going
Policy 49. Evaluate new transmission lines for visual and environmental impacts.	Planning	Project review.	Less visual and environmental impact from transmission lines.	Fees	On-going
Policy 50. Preferences for siting new transmission line corridors.	Planning	Project review.	Less visual and environmental impact from transmission lines.	Fees	On-going
Policy 51. Existing access roads should be used wherever possible.	Planning	Follow guidelines for project review.	Less visual and environmental impact from transmission lines.	Fees	On-going
Policy 52. Buffer zone for new or major additions to fossil fuel facilities.	Planning	Project review.	Reduce potential hazards.	Fees	On-going
Policy 53. Encourage the upgrade or replacement of existing, older facilities.	Planning	Project review.	Reduce potential hazards.	Fees	On-going
Program 53.1. Develop an inventory of all existing fossil fuel facilities.	Planning	Inventory facilities.	List of facilities. Identify problem areas.	General Fund/ Grants	Short
Policy 54. Coordinate with state and federal agencies.	Planning	Follow guidelines for project review.	Less environmental impacts and potential hazards.	General Fund/ Fees	On-going

Policies and Programs	Responsible Agency	Action Required	Expected Benefits	Funding Source	Priority
Policy 55. Encourage the establishment of a safety review committee.	Planning	Follow guidelines for project review.	Reduce potential hazards.	Fees	Short
Policy 56. Prevent oil, gas, and other toxic releases into the environment.	Planning	Project review.	Less environmental impacts.	Fees	On-going
Policy 57. Require consolidation of facilities.	Planning	Project review.	Less environmental impacts.	Fees	On-going
Policy 58. Existing energy sites take priority over opening up additional areas.	Planning	Follow guidelines for project review.	Less environmental impacts.	Fees	Short
Policy 59. Construction of new processing facilities are not redundant.	Planning	Project review.	Less environmental impacts.	Fees	On-going
Policy 60. Extended reach facilities need specific plan approval.	Planning	Project review.	Less environmental impacts.	Fees	On-going
Policy 61. Extended reach facilities should minimize surface disturbance.	Planning	Project review.	Less environmental impacts.	Fees	On-going
Policy 62. Consolidate new pipeline corridors within existing ROW.	Planning	Project review.	Less environmental impacts from new pipeline corridors.	Fees	On-going
Policy 63. Encourage common carrier or multiple-user pipeline construction and use.	Planning	Project review.	Less environmental impacts from new pipeline corridors.	Fees	On-going
Policy 64. Approved oil spill contingency plans shall be submitted to the county.	Planning	Project review.	Less environmental impacts.	Applicant	On-going
Policy 65. Policies to implement in the event of a petroleum or hydrocarbon release.	Planning	Project review.	Less environmental impacts.	Fees	On-going

APPENDIX D: ENERGY PROJECTIONS

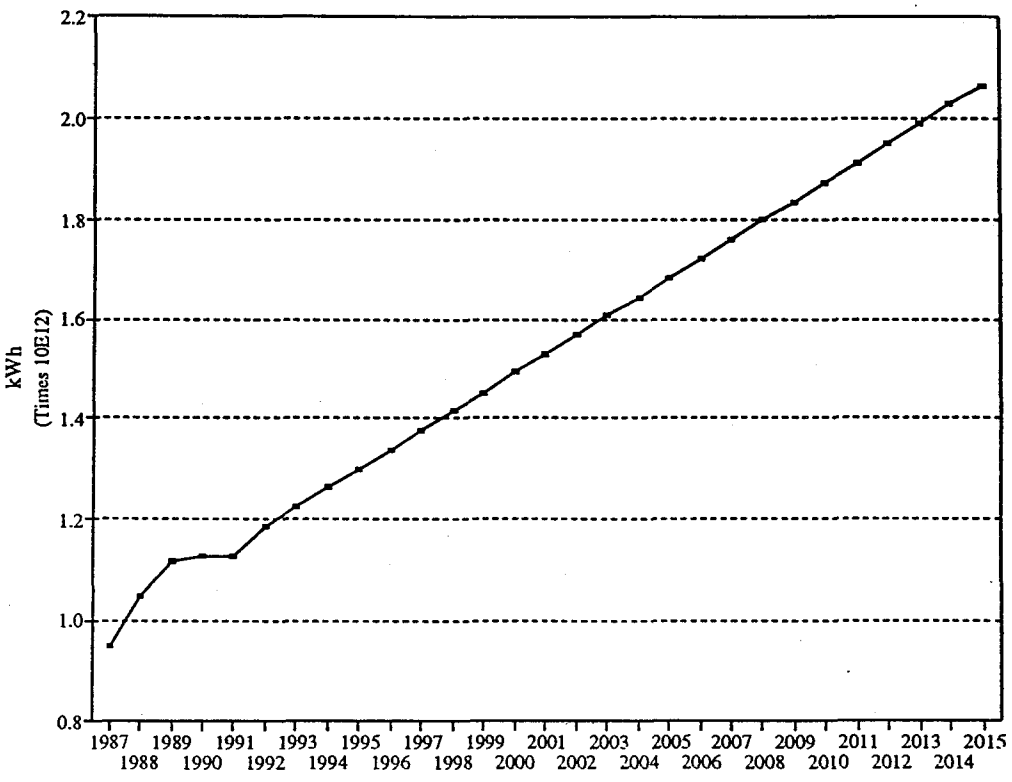
Electricity and natural gas energy use and projected use tables and charts.

Electricity Use Table
San Luis Obispo County 1987 to 1991

Year	Use (kWh x 1000)	Avg. Annual Increase (%)	Household Population	Sales Per Capita (kWh x 1000)	Avg. Annual Increase (%)	MMBtu Per Capita
1987	947,276,000	---	179,599	5,274	---	18.00
1988	1,047,170,000	12	185,437	5,647	7	19.27
1989	1,116,282,000	7	192,588	5,796	3	19.78
1990	1,124,663,000	1	201,240	5,589	-4	19.07
1991	1,123,406,000	0	205,212	5,474	-2	18.68

Source: California Energy Commission, *Quarterly Fuel and Energy Report San Luis Obispo County*, 1992.

Actual and Projected Electricity Sales



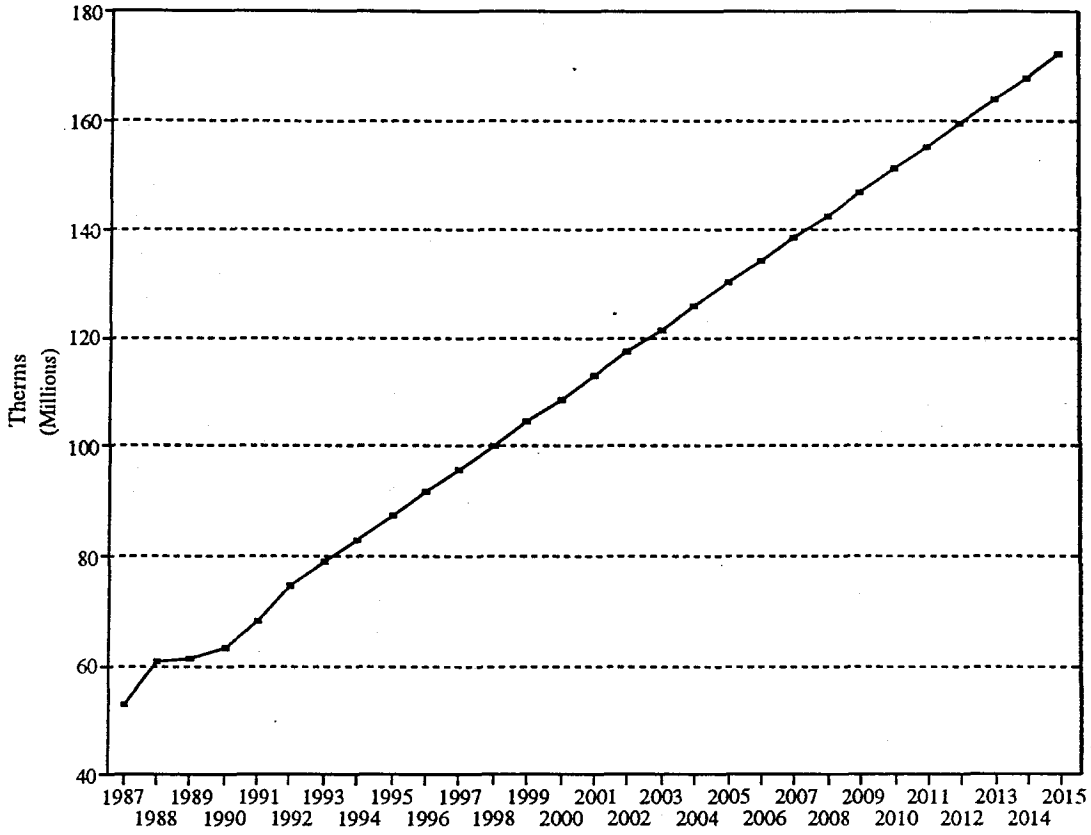
Data: San Luis Obispo County 1987 to 2015.
Source: CEC, *Quarterly Fuel and Energy Report San Luis Obispo County*, 1992.

Natural Gas Table
San Luis Obispo County 1987 to 1991

Year	Use (therms)	Avg. Annual Increase (%)	Household Population	Sales Per Capita (therms)	Avg. Annual Increase (%)	MMBtu Per Capita
1987	52,741,000	---	179,599	294	---	29.37
1988	60,698,000	15	185,437	327	11.22	32.73
1989	60,888,000	<1	192,588	316	-3.36	31.62
1990	63,384,000	4	201,240	315	-0.32	31.50
1991	68,033,000	7	205,212	332	5.40	33.15

Source: California Energy Commission, *Quarterly Fuel and Energy Report San Luis Obispo County*, 1992.

Actual and Projected Gas Sales



Data: San Luis Obispo County 1987 to 2015.
Source: CEC, *Quarterly Fuel and Energy Report San Luis Obispo County*, 1992.